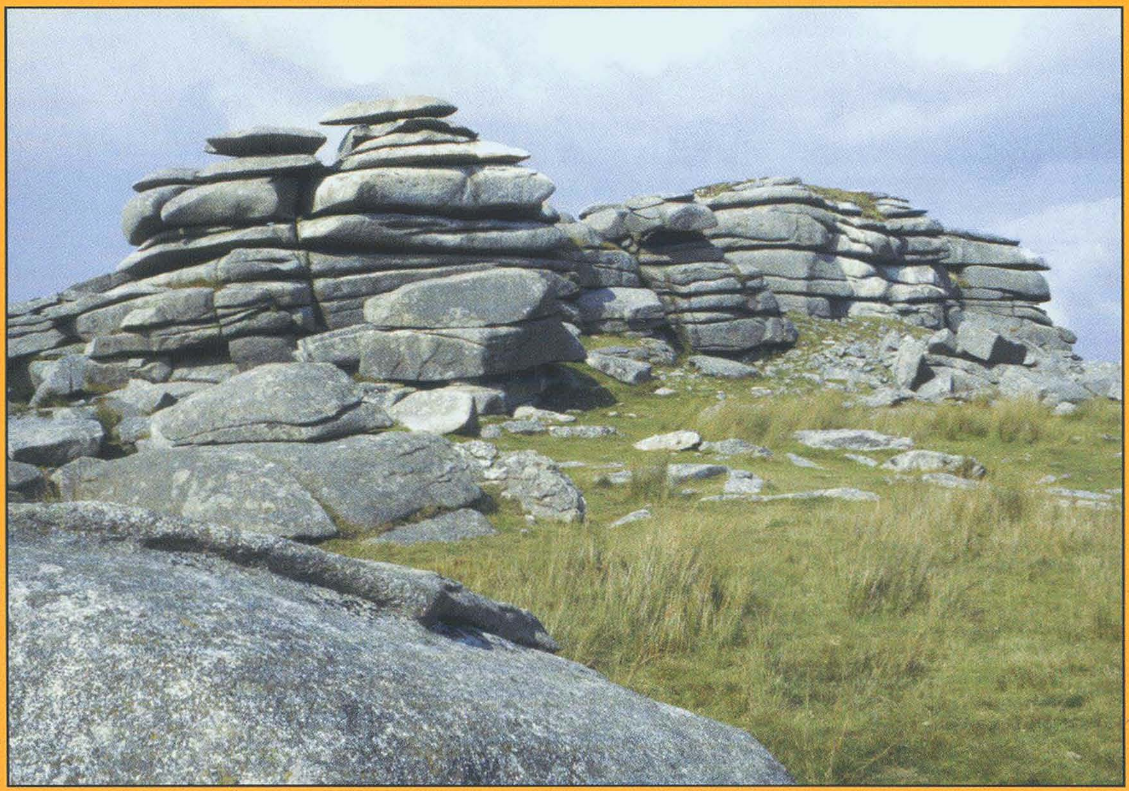
ORIGINS

The Journal of The Biblical Creation Society

No.32



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Granite Formation in Short Timescales

Icons of Evolution

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Editorial

NUMBER 32 in the *Origins* series is also the first issue of the designated 'technical journal'. As editors, we seek continuity with the past in the way we aim to publish original thinking, that looks to develop the agenda set out in the *BCS Creation Manifesto* and giving priority to U.K. authors. There is a conscious departure from the past in the guidelines we give to contributors: primarily in terms of the length of articles published. We also want to encourage a greater diversity of contributions in each issue.

Feedback from earlier issues of *Origins* suggests that although the articles have been useful, many of our readers have balked at their length because they are not sufficiently immersed in the subject to benefit from the intensive read. The most significant new feature in the technical journal is the 'Journal Club' section: short articles that bring important and significant research papers to the attention of readers.

The *BCS* Strategy discussions during 2000 highlighted a major problem- the need for "fresh blood" in U.K. Creationism. We need people who not only are able to relate their Christian worldview to their academic life and to the world of work, but are also able to share their understanding with others. By and large, it was thought that Christians generally are not making much headway in this area. Christians in the world of scholarship are too often difficult to differentiate from their non-Christian colleagues, and this situation needs to change as a matter of urgency. Our prayer is that the new *Origins*, in both technical and popular formats, will contribute to the change.

As a further measure, *BCS* has two email information and discussion lists: one majoring on the earth sciences and the other on the biological sciences. These lists are open to all *BCS* members with a desire to engage with the implications of current research. These lists are primarily for information sharing, but they have proved useful in taking discussion forward. It is hoped that members of these list will be able to meet annually, conferring along the lines of the Fachtagung workshops organised by Christians in Germany (see the report in this issue).

N.M.D., D.J.T.

Brief Guidelines for Contributors

Following feedback from readers, we hope that technical articles will have a more readable style in future. The readership of the journal is diverse and this poses a particular challenge for our contributors. There is always a tension between providing adequate information and arguments in sufficient detailed to be able to answer our critics and at the same time provide a easily readable account of the issue in hand. We encourage all who are planning to write for *Origins* to read *Notes for contributors to Origins* which can be obtained from the editors. A few key points are given below.

Although some flexibility is required, imagine that you are writing for an intelligent eighteen-year-old.

Contributors must be in agreement with the doctrinal basis of the Society and must be seeking to develop the framework set out in the Creation Manifesto, both of which are available from the P.O. Box address of the *BCS*.

We ask that articles are no more than 4,000 words in length. If your article requires more than this and it is not easy to divide into a series of shorter articles, please consult the editors.

Please use plain English rather than technical jargon; write as your would speak rather than using an artificial literary style. Use headings to break up the text.

Please do not include headers and footers. Any footnotes to be included should go at the end of the text and be marked as such. Similarly, if you think that it would be helpful to put small amounts of text in boxes, please separate the text out to indicate where it should go, but leave the typesetters to set up the text boxes.

A short layman's summary of the main points of the article and implications for creationism should be included.

Scientific terms should be explained in the text. We encourage the use of text boxes to provide detail for those interested, while allowing the general reader to move more quickly through the main points of the article

Short articles of up to 1,000 words are also welcome.

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ORIGINS
• Journal of the Biblical Creation Society •

No. 32 2001 Technical Issue

Meetings & Media

Revisiting the Wilberforce–Huxley Debate

John Hedley Brooke looks again at the famous debate and concludes that it was far from a simple 'religion versus science'. His lecture at Cambridge is the subject of a report by Pete Williams. 2

Creation-based Biology in Germany

Topics discussed include basic type biology, fossils, homology, genes and coded information. Sheena Tyler reports on the Wort und Wissen biology Workshop and comments that the Bible is clearly shaping the scientific research that is under way. 3

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The Flood Bottleneck and Genetic Diversity

In a thought-provoking and for some a controversial article, Marc Surtees probes the thorny issue of the genetic bottleneck at the Flood compared with the diversity seen today. He offers the concept of created genomes 'designed to vary'. This is an article to stimulate discussion. 6

Sola Scriptura and Science

What place has our understanding of natural sciences in biblical interpretation? This is the question that Phil Duce considers in this article. He contrasts the opinions of two theologians and concludes that the correct path must be that Scripture takes precedence over science. 10

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Rough Tor, Cornwall, is a fine example of a weathered granite tor. For years, people have been taught that granite took very long periods of time to form —but the textbooks need rewriting.

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John Hedley Brooke: *Revisiting the Wilberforce – Huxley Debate*

Monday 26th February 2001, The Queen's Lecture Theatre, Emmanuel College, Cambridge

Pete J. Williams

A SERIES of lectures on science and Christianity is being supported by the Templeton Foundation and sponsored by St Edmund's College, Cambridge, and *Christians in Science* (see http://www.st-edmunds.cam.ac.uk/cis). As part of this series we have an exciting contribution from John Hedley Brooke, Andreas Idreos Professor of Science and Religion at the University of Oxford, and author *inter alia* of *Science and Religion: Some Historical Perspectives* (Cambridge, 1991).

Though Brooke shows no obvious sympathy towards a modern creationist position, he is someone with whom creationists often find common ground in his challenging of stereotyped images of discussions of the past. For reasons of space only select key points of his lecture are summarised here.

His subject was the British Association debate, on 30th June 1860, between Darwin's friend Thomas Henry Huxley and Samuel Wilberforce, Bishop of Oxford. In traditional lore, this debate was an overwhelming victory for the scientists/Darwinists (represented by Huxley) in their confrontation with religion (represented by Wilberforce). The moral: do not let religion interfere with science. Brooke examines a wide array of sources describing the debate and undertakes an analysis of the intellectual context in which the debate took place.

According to Darwinists close to the event, it was not a straight victory for them: Huxley's son, Leonard did not see the debate as a victory for his father and Joseph Hooker, in his self-aggrandising account, records that Huxley's bad voice meant that he hardly caused a stir. One person, Henry Baker Tristram, came to the debate a Darwinist and left rejecting Darwinism. It seems that the event only came to be seen as a key Darwinist victory in the 1890s. Huxley's supposedly gleeful observation that *'the Lord has delivered him* [Wilberforce] *into mine hands'* is not referred to in sources contemporary with the debate, and is probably a later accretion. Thus according to Brooke, the debate has taken on the character of a foundation myth for Darwinism.

Brooke evaluates the positive import of the debate in its historical context. First, as Leonard Huxley pointed out, it seems that the debate was groundbreaking in the open resistance to authority expressed at the meeting. Writing to Thomas Huxley shortly after the debate, Darwin sees this as the real significance of the debate. It cut across the then accepted pattern of not pressing heterodox views if these might stumble others.

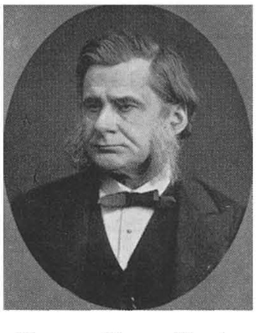
Samuel Wilberforce

Moreover, the debate cannot be cast as a simple clash between science and religion: Wilberforce was well versed in matters scientific and had been primed by Richard Owen, superintendent of the British Natural History Museum, on a number of scientific objections to the theory of Darwin. He had written a lengthy review of Darwin's *Origin* before the debate, including significant scientific objections. Though Wilberforce accepted Natural Selection as a force to prevent the deterioration of biological systems, he noted the lack of transitional fossil forms predicted by the theory. He also criticised Darwin's theory for seeking a unified common descent of species, which went beyond the data.

When we look at the background to the debate, it needs to be recognised that it came in the context of tensions due to the professionalisation of science. Whereas earlier one might be a cleric and a naturalist (as were Wilberforce and his geological teacher William Buckland), later, people tended to be scientists or clergy exclusively.

Another factor in the background was the explosive volume *Essays and Reviews* (London, 1860), written by a number of churchmen. This tome was quite open in its promotion of biblical criticism that questioned the authenticity of biblical statements. Wilberforce's own opposition to *Essays and Reviews* made him enemies even among churchmen, and this may have led clerics to oppose his position in the debate with Huxley. At any rate there were theologians and scientists on both sides of the debate.

The work of Brooke shows that the model of a plain science–religion conflict is too simple, and he does much to exonerate those with whom modern creationists would find considerable affinity. However, while Brooke is more prepared to speak of conflict than some in *Christians in Science*, creationists would not want to understate the extent to which there was a real science–religion conflict due to a conflict between the claims of the text of the Bible and the models of science espoused at the time of the debate. Though the professionalisation of science should be seen as part of a general trend towards increased specialisation which continues even today, the conflict between the text of the Bible and the models at the time was also no doubt a *catalyst* in the process of


Thomas Henry Huxley

separation between clerical and scientific expertise. Thus one of the factors that might be argued to mitigate the science–religion conflict at the time of the Wilberforce–Huxley debate may itself result from the reality of the conflict between the paradigms then espoused for understanding earth history and the plain sense of Scripture. Recognising the reality of this conflict is fundamental to reversing the compartmentalisation of science and religion which Huxley, Wilberforce, Brooke, and we, in our quite different ways, resist.

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ANON, 1861, *Essays and Reviews* 5th edition, Longman, Green, Longman and Roberts, London, U.K.

BROOKE, J. H., 1991, *Science and religion: some historical perspectives.* Cambridge University Press, Cambridge, U.K.

The text of this lecture is now in print:

BROOKE, J. H., 2001, *The Wilberforce—Huxley debate: why did it happen?*, Science & Christian Belief, 13(2), pp.127–141.

The author is most grateful to Professor Brooke for comment on an earlier draft of this summary.

Creation-based Biology in Germany

Sheena E. B. Tyler

WHEN we allow the Bible to shape our scientific research, the result can be a whole new dimension of progress. This is what Christians in Germany have been discovering.

The Germans' ideas are communicated at Fachtagungs, which are technical workshops held annually by Wort und Wissen, a German Creationist organisation. Typically around 50 people attend, ranging from students to professors. There are Fachtagungs for each of a number of subject disciplines, including biology, geology, anthropology, philosophy and education. Sheena Tyler gives the following report from the Biology workshop 2001.

Biology and the Bible

Siegfried Scherer, Professor of Microbiology and Chairman of Wort and Wissen, opened the Fachtagung by saying that it was important for us to have fellowship with one another and the Creator. Then he went on to ask 'How can we understand biology when believing in the Bible? The basis on which we believe is revelation: we believe because the Lord is alive, and acts in our lives. This starting point shapes the construction of our experiments, and the theories emerging from the data: Scripture is the basis.'

Basic types of life: Genesis and Biology

An important concept for creationists is the Genesis kind: animals and plants created to reproduce after their own kind, as described in the creation account of the Bible. This basic type biology has been a particularly fruitful area of research. The opinion amongst many creationists today is that these kinds in general represent higher taxonomic groups such as the family. In the last decade, the Germans have made exciting progress using hybridisation (cross-breeding) and other data (see the table on the outside back cover). They have added several more plant basic types recently, so they now have between 20 and 25 demarcated.

Mechanisms of programmed variability

The emphasis of the German group is now turning to the mechanisms of programmed variability which can explain phylogenetic history, not as a pathway from primitive to derived, but from variable to more specific. Dr. Judith Fehrer described mechanisms in current literature which could explain how large phenotypic changes occur rapidly within a basic type. Firstly there are heterotopic mutations, whereby genes are transposed into a new position and context, leading to the expression of a structure in a different place. Secondly, a heterochronic mutation changes the timing of expression of a gene. Plant phenotype provides an example of how changes in these programmes can lead to changes in morphology and growth form within a genus. In flower development, there are three subgroups of gene complexes that interact to give either sepal development, petal formation, microsporophyll development or macrosporophyll (leaf) formation. In the flowering plant *Streptocarpus*, one phenotype has a large leaf emerging from the first cotyledon. Another phenotype makes rosettes involving repetition of the first type. This is a heterochronic change: in the first example the development of the leaf is switched on early and the stem is late. In another example, grasses, a whole range of morphological phenotypes can be explained by heterotopic rearrangements in gene linkage groups.

Dr. Fehrer welcomed the discovery of these underlying mechanisms. She commented that they could provide the basis for larger phenotypic changes than can be achieved by selection or drift, an empirical explanation for rapid diversity from the first created types, and therefore the substance behind programmed variability. In comparison, evolutionists want to use these mutations to explain the generation of the fundamentally different body-plans of, for example, those of molluscs, echinoderms and vertebrates. The important question of limits to such variability was then raised. Do they have endless capacities, as the evolutionist thinks, or are there boundaries?

Evidence from fossils is consistent with the Bible

Rapid deposition of sediment would indicate a short time-frame for earth history, consistent with the biblical account.

Excellent evidence for this has been found in the chalk layers of Baden-Wurtemburg in the Schwabischen Alps by Dr. Manfred Stephan, a research geologist employed by Wort und Wissen. He described fossilised fish passing through several layers of sediment and also, an ammonite found with its soft body parts still present. The specimen was embedded vertically through eight layers. In another example, a fish was thought to have started to decay, giving off gases leading to an expansion of the entombing cavity, followed by a collapse and compression of the void. This would only happen if there were already a considerable amount of sediment overlying it. One fossil was particularly impressive. It was a belemnite that passed through several layers of sediment (figure 2), with contact deformation indicating movement before solidification.

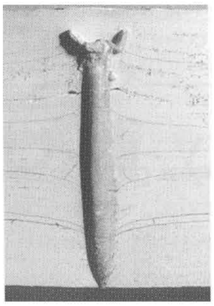

Figure 2

Homology

The issue of homology, which is used as a proof by evolutionists, was raised by Dr. Reinhard Junker. Firstly, certain pathways of evolution in body structure have been assumed but are now in doubt because the ontogeny (development from the embryo) of the various forms is very different. Secondly, homologous genes carry information for non-homologous adult structures. Therefore molecular mechanisms are not sufficient to explain adult homology. Thirdly, developmental constraints seem, if anything, to conserve pattern and form. Dr. Junker also commented on his work with fossils from the Carboniferous and Devonian periods saying that it was very difficult to create a phylogenetic tree on the basis of plant fossils from these periods because it is not known which features are primitive and which are derived. Junker also spoke of how, as a biology student, evolution seemed plausible. Then he read the Bible, with the plan of salvation, and became a Christian. This led him to wonder about the meaning of sin if we are only upgraded animals. The plan of salvation makes no sense against a background of evolutionary theory.

Design signals

Siegfried Scherer, Professor of Microbiology at the University of Munich, spoke of design signals in functional gene transfer. He reported on a paper in *Nature* (Adams *et al.*, 2000) concerning the distribution of genes in the mitochondria and nuclei of plant cells. One particular ribosomal protein gene, rps 10, was found to be distributed differently through the plant kingdom, as indicated by the 277 plant genera screened. In some genera it is located in the nucleus, in others it is in the ribosomes. Also, the specific protein targeting signals synthesised in the nucleus vary between the genera. This means that functional gene transfer from the mitochondria to the nucleus must have happened independently on many occasions and yet it is a very complicated event. The authors of the paper calculated the probability of functional gene transfer of rps 10, and concluded that such a functional gene transfer is as likely as a single neutral mutation in a protein coding gene.

'This is amazing,' commented Scherer. 'There are many different steps required for gene transfer to occur. Therefore it appears to be evolving too fast! It is similar to making the claim that a single bacterial cell could evolve from organic matter in a few days.' Three possibilities were offered to explain the data:

1. The authors made an error in their calculation of the rate of evolution. This is highly unlikely for such intelligent authors.
2. There are unknown mechanisms of gene transfers between mitochondria and nuclei that operate extremely fast.
3. The genes in the nucleus did not come from the mitochondria, but are so similar to them that convergence is unlikely. So how did they get there? One possibility is that this is a design signal: a structure which in a functional context is unlikely to happen in a short timescale. If that is the case, then gene transfer may be yet again a matter of programmed variability.

Wolfgang Lindemann is a medical doctor conducting research into circadian rhythms involved in sleeping disorders and jet-lag. Humans have a variety of patterns of when they should be sleeping or awake. The general principle is that there is a central pacemaker and a subsystem that regulates other processes, and is regulated to a 24 hour period. A cytochrome recognition signal absorbs sunlight, and the system can be fine-tuned by sunlight to adjust for longer or shorter days. A similar process has been found in the mouse, in mushrooms and fish, but using different molecules. So, in very different organisms, there are similar principles, particularly the feedback loop to autoregulate, but there are different molecular components. The best interpretation of this is that these systems were created, using similar constructional concepts, in the various organisms, but with species-specific molecular components.

Klaus Neuhaus reported about the gene tinkering concept and asked, 'can new information become integrated into complex biological systems?' Gene tinkering has become a fashionable model, but there are only a few examples to show that it is working. The mere tinkering, or shuffling, of intron:extron levels is plausible, but can this be extrapolated to explain, say, the evolution of eye development? Eye development is a very complex process, requiring 2,500 genes! Take the five different families of G proteins in various animals. The G protein needs to be specific, so does the receptor, and also the phosphorylator with which it must link. One cannot just take one element out: all components are specifically adapted to one another. Organisms resemble the computer board, with its complex integrated circuitry, rather than the tinker's simple table. The author concluded that gene tinkering is a general concept with no substance.

Biological information

Royal Truman reported on how the laws of nature plus randomness are insufficient to describe the behaviour of physical systems. Examples included bird, fish and eel migration; the bee's waggle dance; cellular processes and numerous human artifacts, including computers and printers, which share properties of Coded Information Systems. These all require coded messages, a sender and decoder. In addition they share many other properties:

- The intention of the coded message is processed through a hierarchy of layers.
- The systems possess specialized equipment to ensure intended outcomes.
- The equipment and messages are designed for specific systems.
- The effect is to guide behaviour over time and distance.

This framework allows biological machine-like behaviour such as demonstrated by foraging bees and cellular processes to be understood and quantified. Only an intelligent agency can create coded information systems.

The work of Wort & Wissen

There are a number of facets to report on the wider scope of the Germans' mission.

1. As well as the technical workshops, they also hold a national Congress suitable for non-scientists, in which they report about their work in a non-technical way.
2. There are four full-time and two part-time staff members. Thomas Futcher is a geoscientist conducting original research on heat transfer in ocean ridges, in conjunction with computer modelling. Manfred Stephan is conducting field research in classical geology according to the young earth model. Reinhard Junker works on the homology issue and writes books on paleobotany. Harold Binder and others conduct literature searches and give lectures to churches.
3. Apart from much material at the popular-level, they publish scientific monographs. These are technical—indeed they are too technical for some—but provide a scientific basis of reference, and have been influential. Staff members are sometimes asked, 'Where is the science?', so these monographs meet that need. Siegfried Scherer commented that creationists can be perceived as being extremists and untrustworthy. He commented 'Indeed, some creationist material is dogmatic fanaticism, seeking easy answers, simple scientific facts that "prove" the creation position … the "single blow creationists"! We seek to produce literature that is sound science, which should teach deeply into matters. We need to explain to churches that there often are no simple answers. We have to live with problems in life in general. The basis of our faith is related to the Word of God (Hebrews 11:3).'
4. They have also written a textbook, *Evolution—ein Kritisches Lehrbuch*, of which over 40,000 copies have been sold (figure 3). Since it is not too technical, and beautifully illustrated, it is suitable for teachers and every family with a child in secondary school.
5. Their emphasis is not the six days of creation, but theological. Siegfried commented 'It is futile for the six days to be our basis. Rather it should be the person of Christ, the Creator. By the sin of one man death came into the world. In an evolutionary framework this makes no sense, but it is the centre of the apostle Paul's theology. If that one man, Adam, had not brought death, why do we need to be saved? Could that same Jesus, (the caring Creator) really have used the method of evolution to create (*i.e.* using death and destruction)?'

Conclusions

What can we learn from the Germans in all this?

Firstly, they tailor their meetings very carefully, to differentiate between the technical and the popular. The technical workshops concentrate on that specific subject discipline, so everyone understands and can become involved in ideas and models. Ideas can be disseminated as a rough framework and then developed. Newcomers can learn and catch the vision. There is also the simple joy and inspiration of meeting together, as indeed our *BCS* earth science group has done in the past. Times of prayer are included for matters of real need: students at cross-roads in their studies, job difficulties and so on. We can all enter into the excitement of finding how our science really can work in a Biblical framework, and that this can be fruitful. The creation model can shape our science much more productively than the evolutionary model, which struggles to explain the data. It is possible to make sound science on a Biblical basis, as Siegfried Scherer said in his opening comments. This is beautifully exemplified at the biology workshop reported here, where their basic type biology is now well founded and they now seek the mechanisms of programmed variability and design signals.

Secondly, Wort & Wissen consists primarily of 'young earthers', but they are also like many in the U.K. in not making this their primary platform. They stress the importance of death and the significance of the first Adam and Christ, the second Adam.

The Wort und Wissen strategy is instructive to us. We can learn from these brothers and sisters, just as we did from Martin Luther. The Reformation changed the face of Christianity in Britain. So could this!

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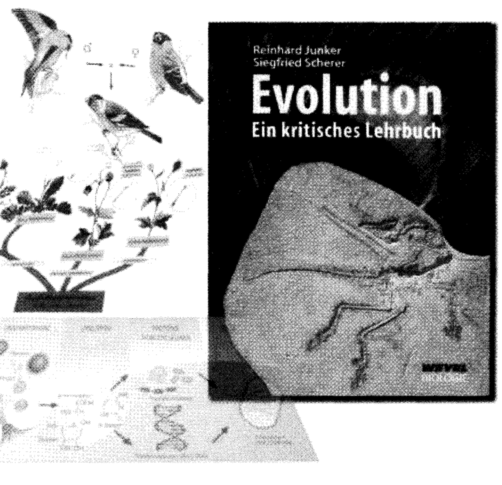


Figure 3

The Flood Bottleneck and Genetic Diversity

Marc Surtees

THE INTEREST in conservation of declining populations of rare species and the desire to preserve biodiversity has resulted in a lot of research into the effects of population bottlenecks. Unless an effective form of intervention is possible the result is often extinction. A key criterion used to measure the effectiveness of such intervention is the recovery of genetic diversity that is thought to be necessary to ensure fitness. Two commonly used measures of genetic diversity are heterozygosity and number of alleles.

Scriptural biologists are concerned with genetic diversity not only because of the importance of conservation but also with reference to the genetic bottleneck that occurred as a result of the biblical flood. It has been shown that the level of genetic diversity is related to the size of the founding population and the growth of that population. Furthermore, the findings of population geneticists appear to be inconsistent with a recent flood bottleneck.

The bottleneck effect

A key study of the effects of a genetic bottleneck was that published by Nei *et al.* (1975). Their analysis was a quantitative one that evaluated the loss of genetic diversity following a bottleneck and determined how quickly the original or a new level of heterozygosity could be attained in the fruit fly, *Drosophila pseudobscura.*

This was a theoretical study of the effects on a population that has passed through a bottleneck. The authors found that the average heterozygosity is expected first to decrease to a minimum and an increase will not occur until the population becomes sufficiently large. The actual minimum level of heterozygosity depends on:

- The size of the population (N_0) that survives the bottleneck
- The mutation rate (v)
- The rate of population growth.

The decline in heterozygosity is less if the population growth rate is high. If N_0 is 10 and the population is growing rapidly the reduction is negligible, even with a low mutation rate ($v=10^{-8}$).

Their working assumptions were that:

- The population was randomly mating with discrete generations.
- Average heterozygosity of natural populations (of fruit flies) is around 20%
- The number of alleles per locus was around 4 to 6.

One of their conclusions was that with N_0 of 2, recovery of genetic diversity can take millions of generations. They also concluded that if only two individuals survive the bottleneck, half the alleles will be lost, whereas if ten individuals survive slightly less than half will be lost.

Effect of the flood bottleneck

These conclusions are of interest to students of the Bible because the biblical flood was an extreme genetic bottleneck that would have had a major impact on the genetic diversity of all the organisms that were preserved on the ark. Furthermore, this recent bottleneck would appear to severely constrain the level of genetic diversity we would expect to see today, especially if recovery of genetic diversity requires millions of generations.

Woodmorappe (1996) has examined the problem of recovery of heterozygosity and origin of new alleles. He suggested, fairly convincingly, that recovery of heterozygosity was definitely possible given the starting conditions indicated in the Bible. These conclusions appear to be confirmed by recent reports. For example Groombridge *et al.* (2000) reported the rapid recovery of genetic diversity in the Mauritius kestrel and Britton-Davidian *et al.* (2000) have reported high genetic diversity in an island population of mice.

Woodmorappe (1996) assumed that in general the present number of allelic forms throughout most of the genome is rather small (five or less) and therefore a few hundred generations would be more than enough to generate new alleles to compensate for the reduction in alleles that would have occurred during the flood bottleneck. He also examined the origin of new alleles within the human major histocompatability complex (MHC) which is known to have around 200 allelic forms (The MHC sequencing consortium, 1999). The MHC appears to be a special case as the chromosomal regions which are associated with antibody production appear to contain mutational 'hot spots' that generate useful genetic diversity to ensure a supply of novel antibodies to combat infection.

Heterozygosity is a measure of the proportion of heterozygous individuals in a population, referring to a given gene locus or all loci. An individual is heterozygous for a particular loci (associated with a gene) if they are carrying two different alleles of that gene.

An allele is one of a number of forms of the same gene responsible for determining contrasting characteristics.

Human genetic diversity since the flood

There are at least two other human genes that are known to have many allelic forms: the genes for hæmoglobin alpha and beta chains (Lehninger, 1975). There are about 150 different forms of hæmoglobin that appear to result from single amino acid replacement in either the alpha or beta chain. Two examples are the mutations associated with thalassæmia and sickle cell anæmia, that are noticeable because of their harmful effects, however the others do not have such dramatic effects. It is estimated that 5 out every 1000 individuals carry mutant genes for hæmoglobin. As Noah and his family cannot have carried more than 10 alleles in total the vast majority of these phenotypes would have had to have arisen since the flood. Therefore it appears that we need to address two difficulties that arise from the assumptions of modern population genetics. The first is that new alleles are easily lost and the second is the low mutation rate (10^{-6} at most).

Survival of new alleles

Li (1978) has calculated the probability of extinction of a single mutant gene and Table 1 is adapted from his book on population genetics.

In agreement with all the texts on population genetics this result suggests that even when a new allele arises it is very likely to be lost, with a small reduction in the probability if the new allele provides a selective advantage. However, this conclusion is a result of the assumptions that are used. *i.e.* the parents produce an average number of two offspring that survive to breed in each generation.

Table 1

The probability of extinction of a single mutant gene.

Generation	With no selective advantage	With 1% selective advantage
1	37%	36%
2	53%	53%
3	63%	62%
15	89%	88%
127	99%	97%

Here, we suggest that the conditions existing just after the flood bottleneck would have preserved any alleles that survived the flood bottleneck, and any new alleles would probably have become fixed (see Table 2).

Of more interest to the present discussion is the overall probability that an allele that is present in Noah will be lost in his grandchildren because it provides us with a better estimate of the likelihood of an allele becoming fixed in the post flood population.

Assuming independence of the transmission to Shem, Ham & Japheth we can calculate the overall probability of loss of an allele (see Box 1) in these men and their male offspring as the product of these probabilities of loss in the individual lines, viz: (33/64)(129/256)(17/32) = 13·8% (Johnston, personal communication). Thus, the probability that an allele carried by Noah will not be carried by at least one of his grandsons is 13·8%. Furthermore, we can safely assume that each of Noah's sons had several daughters. So it seems clear that any alleles transmitted to Noah's sons would have been fixed in his grandchildren. Similarly we can assume that none of the alleles carried by their wives were lost. Therefore we can conclude that any decrease in heterozygosity would have been minor and the level of heterozygosity observed today would have been reached fairly quickly in a post flood world where family size was large and the population growth rate was high.

Table 2

The probability of loss of alleles in Noah's family.

The probability of the loss or extinction of an allele in the next generation is heavily influenced by the number of viable offspring. Let k be the number of offspring produced by the mating AA x Aa. The probability (P) that a will be absent among the k offspring is given by the relationship q^k where q is the probability that one individual will inherit the allele a. In this case q is equal to 0·5 and the table below gives the probabilities for the loss of alleles carried by Noah or by one of his sons.

	Number of male offspring	Probability of losing an allele present in the parent
Noah	3	12·5%
Shem	5	3·1%
Ham	4	6·3%
Japheth	7	0·8%

The origin of new alleles

The large number of hæmoglobin alleles at detectable frequencies appears to pose a more serious problem for those who believe that only a few hundred generations, at most, have elapsed since the flood.

The relative frequencies of the alleles suggests that it is unlikely that the maximum number of ten alleles per locus were carried by the human population of the ark. If the theoretical maximum of ten alleles were carried by the human population of the ark one would expect to find eight or nine alleles at about the same frequency and this is not the case for the hæmoglobin gene as only 0·5% carry a mutant form of either the alpha or beta chain gene. Therefore the vast majority of these new alleles must have arisen since the flood.

An estimate of the time required for any new allele to reach a certain frequency is directly proportional to the mutation rate (v). This is usually expressed as the number of generations (see Box 2 for details).

Taking the example of one chain of hæmoglobin and assuming that the mutation rate (v) is 10^{-6} then the number of generations is 2,500. This is around 62,500 years (25 years = generation time). The assumptions underlying this calculation are:

- The mutation rate is constant.
- There is no selective advantage for any particular mutation.
- There are no back mutations.

1

The survival of alleles in Noah's family

The probability that an allele is absent in X's line in an individual in the first generation is q.

The probability that an allele is absent in X's line in an individual in the second generation if he has x offspring is:

$$q + q^x - q^{(x+1)}$$

For Shem: $p = q = 0.5$ and $x = 5$, therefore $P = 1/2 + 1/64$
For Japheth: $p = q = 0.5$ and $x = 7$, therefore $P = 1/2 + 1/256$
For Shem: $p = q = 0.5$ and $x = 4$, therefore $P = 1/2 + 1/32$

The last assumption is almost certainly false and could lead to a much lower overall rate of fixation of new alleles.

It appears that the mutation rate would have to have been at around $2x10^{-5}$ in order to account for the observed frequency of mutant alleles, even in the absence of back mutations.

This rate of mutation is far higher than that which is currently accepted (10^{-6} is considered rather high and rates of 10^{-8} are often quoted).

The adaptable genome

Even if the case of hæmoglobin is an isolated one (which appears unlikely) there is a need for an explanation for the observed frequency of mutant alleles in the brief time interval available since the biblical Flood. We suggest that the case of the MHC is not so special and that mechanisms exist by which most parts of the genome are capable of generating a great deal of variation on a time scale compatible with the biblical record. Indeed current research indicates that this is not so improbable as it may once have been thought.

Homologous chromosomes pair up before the onset of cell division to form gametes, e.g. eggs and sperm. Alleles occupy the same position on homologous chromosomes.

There are at least eight mechanisms for producing genetic variation: point mutation, DNA based exon shuffling, large scale DNA duplication, unequal crossing over, DNA translocation, site specific recombination, functional processed pseudogenes and exon shuffling by L1 retrotransposition (Moran *et al.* 1999).

1. Point mutations arise when a copying error occurs during DNA replication prior to cell division.
2. There is circumstantial evidence that has lead some experts to suggest DNA based exon shuffling as a mechanism to produce new proteins by moving and rearranging exons (sections of DNA that code for a parts of a protein).
3. Large scale DNA duplication is thought to have occurred because some large sections of DNA appear to be copies of other sections of the same or different chromosomes. These latter two mechanisms are appealed to the explain evolution of the genome on a scale that most scriptural biologists would not accept.
4. Unequal crossing over is the result of a mismatch between homologous pairs of chromosomes that exchange DNA just prior to cell division. Crossing over usually results in an exchange of equal amounts of DNA but it is sometimes unequal and results in a change in the DNA composition of the chromosomes involved.
5. Translocation is the exchanged of DNA between non-homologous pairs of chromosomes.
6. Site specific recombination is a process by which pieces of DNA are inserted into specific areas of the genome by special enzymes.
7. Processed pseudogenes are basically copies of genes without introns. Introns are bits of DNA that are found inside a gene but do not code for any part of the final protein and produce no protein because they are 'switched off'. They can become functional if a promoter sequence of DNA is inserted into them.
8. The L1 sequence of DNA is a section of DNA that can insert itself into different parts of the genome and can carry other bits of DNA with it.

These latter three mechanisms involve what are called transposable elements (transposons), bits of DNA that appear to be able to move around the genome. Although some of these mechanisms are speculative and are based on the assumption that large scale evolution of the genome has occurred, there is good empirical evidence for the existence of transposons. Therefore, when developing biblically constrained models of genetics we should not forget that the genome is very complex and dynamic and point mutations are not the only way for the genome to change.

Furthermore, mutation appears to be switchable under stress, at least in bacteria (Pennesi, 1998). Multiple mutations caused by transposition have been reported for the germ

2

Calculation of generation number to change allele frequency

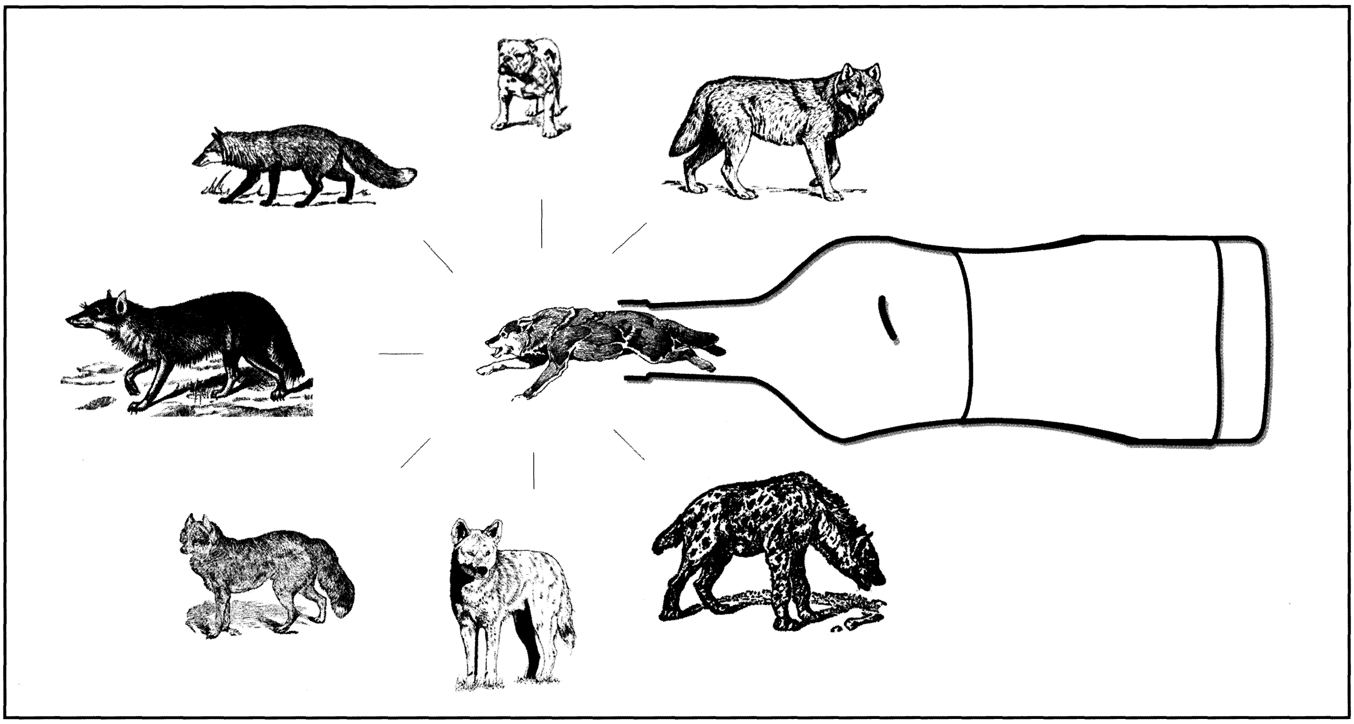
The number of generations (n) required for the frequency of a new allele to change from a starting value (q_1) to a new value (q_2) can be calculated using the following formula provided by Li (1978):

$$nv = \log_e \frac{1 - q_1}{1 - q_2}$$

Taking the example of one chain of hæmoglobin, we can calculate the number of generations that would be required to reach the observed frequency of 0·0025 mutant alleles. Considering all the mutant alleles together and assuming that only one allele for each chain was present on the ark, we substitute 0 for q_1 and 0·0025 for q_2, thus:

$$nv = \log_e \frac{1}{0{\cdot}9975} = \log_e 1{\cdot}0025 = 0{\cdot}025$$

cells of fruit flies (Schwartz, 1995). There is also an increasing amount of evidence that suggests mutation rates are higher than previously believed and human mutation rates could be as high as 10^{-4} (Eyre-Walker and Keightley, 1999). Interestingly, such a high rate of mutation poses problems for an evolutionist because of the burden of deleterious mutations that would be imposed upon the species over the long time scales proposed by evolutionists. However, this would appear to be consistent with a biblically constrained biological paradigm where the amount of time since the flood bottleneck is not enough to cause extinction of the human species. Such high rates of mutation are what we would expect because of today's levels of allelic diversity. This rapid production of new alleles and the fact that there are eight different mechanisms known to increase genetic variability is suggestive of the fact that the whole genome, and not just the MHC, has been designed to generate variability. This hypothesis, of a genome designed to change, provides a mechanism for producing the large number of alleles that must have arisen in the human genome since the recent flood bottleneck.



Conclusion

In conclusion, we propose that the high levels of heterozygosity and numbers of allelic forms that are observable since the recent flood bottleneck are consistent with the known mechanisms for gene fixation and production of new alleles. Also, we would like to suggest that the genome is designed to generate variation over a very short time scale. Such a rapid production of genetic variation may provide a mechanism for the production of the many sub-species and species (such as those observed in adaptive radiations of isolated island species) that must have come from the relatively restricted population of animals on the ark in a short period of time. Furthermore, such a design feature may have been essential for the post flood population to survive and diversify rapidly enough to account for today's observed level of biodiversity within a biblical timeframe.

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For Editorial comment, please see inside back cover.

Sola Scriptura and Science

Philip Duce

WHAT is the proper place of the natural sciences in biblical interpretation? This is an important general question, and of course is of particular relevance to the Genesis–creation–evolution debate. As with so much in this debate, evangelical scholars disagree over what is the appropriate approach. The interaction between two commentators provides a convenient starting point for engagement with this issue.

Henri Blocher addresses the question in his study of Genesis 1–3, *In the Beginning* (Blocher 1984, 24–27). His own response is clear:

> If the Bible is the Word of God, no authority, even one at the apex of the scientific world, may impose his authority on the Bible in order to dictate how it is to be understood, even with the best of intentions ... Instead of an authority, however, a ministerial, servant-role appears possible. In fact, no interpretation can develop in a vacuum; all interpretation appeals to the services of prior knowledge. (Blocher 1984, 25)
>
> [W]e must curb the desire to make the scientific view play a part in the actual interpretation; the interpretation must cling solely to the text and its context. ... We conclude that the place of the sciences in the reading of the Bible is this: they have neither authority, nor even a substantial ministerial role within the actual interpretation; they act as warnings and confirmations at a later stage. (Blocher 1984, 27)

Ernest Lucas has responded to this position (Lucas 1987, 46–48). He observes that Blocher himself allows that the sciences of language and history are in fact used as tools for interpretation,[1] and asks why it should be any different with regard to the findings of the natural sciences. Given that such findings should, in principle, be taken into account, Lucas then asks what principles might govern the use of extra-biblical knowledge in biblical interpretation, and, in the summary of his case, suggests that

> we should follow Calvin and accept gratefully, as God-given, all truth, from whatever source, that might aid us in understanding Scripture. This must be used with care, especially discriminating between reliable facts and theories or opinions. We should accept too his caution that since the Bible is written for the lay person using common idioms and concepts, and with the aim of presenting Christ to us, we do well not to drag it into scientific disputes. Thirdly, we should, like him, have the humility to accept that the findings of the scientists might sometimes help us by pointing out places where the Holy Spirit has made use of 'common usage' or 'vulgar error' to express the truth. (Lucas 1987, 47; *cf.* Lucas 2001, 60–63)

Recently, Blocher has stated that he 'would still resist the arguments put forward by Lucas', and would not entirely follow Lucas's reading of Calvin's commentary on Psalm 58:5 (the source of Lucas's reference to Calvin's acceptance of 'vulgar errors') (Blocher 1999, 39 [note 7]). In support of Blocher, and against Lucas, it is important to note that while Calvin's treatment of 'formal inaccuracy' in Scripture was perhaps unsatisfactory, it is clear that his concern was to show that the Biblical writers did not fall into error (Packer 1974, esp. 105–107).

Echoing Geerhardus Vos (Vos 1975, 36–37) Blocher reiterates his earlier position:

> Faithfully obeying the *sola Scriptura* rule, the 'formal principle' of the Reformers, Christians dare refuse modern scientific knowledge a constitutive role in the interpretation of biblical texts; but a fideistic[2] separation between science and faith betrays the biblical sense of truth. Once instructed by the sovereign Word of God, our faith responsibly welcomes whatever information, drawn from God's 'general revelation', holds proper credentials. (Blocher 1999, 39)

Here, Blocher's invocation of the *sola Scriptura* principle in response to Lucas prompts us to revisit this principle, in order to ask what exactly it does, and does not, imply. We will then be in a position to assess the exchange between these two scholars.

Sola Scriptura

This principle ['Scripture alone'] has been referred to by historians as the 'formal' principle of the Reformation (*cf.* the Blocher quotation), in contrast to *sola fide* ['faith alone'] and *sola gratia* ['grace alone'] which are the 'material' principles.[3] Tony Lane points out that this must be qualified, on two grounds:

> First, the distinction between formal and material principles dates from as recently as the nineteenth century. Secondly, although there are passages from Reformation times in which the words *sola* and *Scriptura* appear in close proximity [*e.g.* Calvin, Institutes, 1:7:1, 1:18:3, 3:17:8, 4:8:12], *sola Scriptura* as a formula or a slogan post-dates the Reformation. ... Like the other two slogans, *sola Scriptura* needs careful unpacking and clarification. (Lane 1994, 298)

Whenever the slogan was introduced, its purpose was to encapsulate the teaching of the Reformers (which, despite shifting emphases, was faithfully received and maintained in the following period of Protestant orthodoxy [Godfrey 1983]). In the article just quoted, Tony Lane sets out a thorough, nuanced analysis, to which Geoffrey Grogan has provided a helpful counterpoint (Grogan 1997). The essential points are summarised here, orientated towards the question posed at the beginning of this article.

1 *Sola Scriptura* does not preclude the use of human reason as a theological resource.

> It is not possible even to read the Bible, let alone proclaim its message, without some use of reason. While the use of specific human disciplines, such as philosophy, biology or psychology, can and sometimes does lead to abuse, it is hard consistently to repudiate such use. (Lane 1994, 301)

God has given us rational faculties, and while these have been affected by sin,[4] revelation and reason should not be viewed as necessarily antithetical. Indeed, there is a fundamental unity between God (the Creator of the universe), humanity (whom He has made, in his own image, to live in that universe) and the Bible (which He has given to tell us, among other things, about the universe and its purpose). This is the basis for 'epistemological confidence', of whatever kind.

Reason, then, has an ordering function, and relates Scripture to other disciplines—but steps outside its proper sphere if it rejects what is given in the biblical revelation (Grogan 1997, 218–219).

2 *Sola Scriptura* does not preclude human reason from being a source.

> Is it conceivable that the study of science and nature can contribute nothing to a doctrine of creation that is not already taught in Scripture? ... This does not imply uncritical absorption of [scientific] disciplines, only that the denial that they have anything to contribute is not realistic. (Lane 1994, 302)

Human knowledge is a legitimate theological source. For example, to pick up on the appeal to Calvin by Lucas:

> Calvin was certainly open in principle to learn from 'secular' knowledge. ... Calvin discerns the admirable light of truth in secular writers. To despise this is to dishonour the Spirit of God, who is its source [*cf.* Institutes 2:2:12–17]. (Lane 1994, 304–305)

However, an important qualification needs to be made: human knowledge is a source for the Christian theologian, not a source of Christian revelation. *Sola Scriptura* does not exclude the status of human knowledge as a source of truth (needing to be correlated with Scripture)—but perhaps it does imply that Scripture is the only source of Christian revelation (Lane 1994, 305–306).

3 *Sola Scriptura* does not deny the role of experience as a theological source or resource.

With regard to the distinction, noted above, between the 'formal' and 'material' principles of the Reformation, Timothy George points out that it 'is misleading insofar as it suggests that the Reformers approached the Bible as a theological axiom or philosophical prolegomenon[5] rather than as the living and powerful oracle of God' (George 1987, 314 *cf.* 82). For example, Calvin's is very much a theology of experience. Christian experience confirms the relevance of Scripture to the Christian life. The former must submit to the creative and controlling influence of the latter. Discrepancy may mean that we have misunderstood Scripture, or that our experience needs to come into conformity with it (Grogan 1997, 219).

4 *Sola Scriptura* does not exclude the Christian tradition and the living teaching authority of the church as a theological source or resource.

The Reformers greatly valued the contributions made to biblical understanding by many of the Fathers. Church tradition is a safeguard against excessive individualism of interpretation, and provides helpful summaries of biblical truth (Grogan 1997, 211). The teaching of the church has an important function in relating biblical truth to present-day issues through exposition and application (Grogan 1997, 214).

Both church tradition and living teaching need to come under the judgement of Scripture.

The Reformers, then, permitted and used all these sources: however, it does not follow that they all have the same status. Scripture is the primary theological resource: the others are not autonomous, and very definitely subsidiary. To quote Packer:

> Like every commentary on the Bible, [tradition] must itself be tested, and where necessary, corrected by the Bible which it seeks to expound. ...
>
> We may not look to reason to tell us whether Scripture is right in what it says (reason is not in any case competent to pass such a judgement); instead, we must look to Scripture to tell us whether reason is right in what it thinks on the subjects with which Scripture deals. (Packer 1958, 48)

5 *Sola Scriptura* does not simply mean that 'all Christian truth is to be found in Scripture' (the 'material sufficiency' of Scripture). The latter is at least a part of what is meant by *sola Scriptura*, but needs to be qualified in a number of ways.

This is a subtle point which requires some historical analysis. On the one hand there is the Roman Catholic sense to affirmation of material sufficiency; on the other, for Protestants, the material sufficiency of Scripture was the subject of controversy between Lutherans and Reformed, or between the establishment and the Puritans in the Church of England (Lane 1994, 313–320).

For example:

> Protestants do not accept Roman Catholic claims that their Marian doctrines are 'implicit' in Scripture. But they would be unwise to base this on the requirement that all doctrine must be explicit in Scripture. The history of Christian doctrine is not just the story of the repetition of Scriptural statements. (Lane 1994, 319)

Affirmation of the material sufficiency of Scripture, then, was not intended to be taken too rigidly. Perhaps it is worth pointing out here that we freely make use of non-biblical terms like 'theology', 'soteriology', 'trinity' or 'spirituality', provided they are interpreted in a biblical manner, to articulate and communicate biblical insights.

6 Sola Scriptura does not imply that Scripture is our sole authority.

To claim that Scripture is our sole authority is no more viable than the claim that it is our sole source or resource. This is acknowledged, for example, in Article 1:6 of the Westminster Confession: the whole counsel of God 'is either expressly set down in scripture, or by good and necessary consequence may be deduced from scripture.'

Reason, and church tradition and teaching (*e.g.* the early Fathers, creeds and councils) have their own authority. For the Protestant Reformers, *sola Scriptura* did not mean *nuda Scriptura* (George 1987, 81, 315). The *sola* in *sola Scriptura* was not intended to discount completely the value of church tradition, but rather subordinate it to the primacy of Scripture. The Reformers insisted that the Bible was self-authenticating: that is, deemed trustworthy on the basis of its own perspicuity, evidenced by the internal testimony of the Holy Spirit.

Human knowledge possesses authority only so far as, and on the grounds that, it is true.

> It is authoritative because it is true, not *vice versa*. For example, what biology or archæology might have to tell us is only authoritative only so far and on the grounds that it is true. The argument 'biology says' or 'archæology says' (or 'archæologists say') has no inherent weight beyond the truth or otherwise of the claim. (Lane 1994, 320–321)

This is a key point with regard to our original question, and one which both Blocher and Lucas would presumably wish to affirm. To be sure, this in turn raises the philosophical question of how the truth-value of scientific truth-claims is to be assessed, but this complex issue does not detract from the essential point Lane makes. We cannot, of course, appeal to Scripture for confirmation of specific scientific theories which it simply does not address, whether directly or indirectly. However, in general terms:

> Theology expresses and applies the *ultimate presuppositions* of the Christian, which must take precedence over all our other ideas. *In that sense*, my theology must take precedence over my geology or my psychology. (Frame 1987, 316, my italics)

Finally, we may note that if reason and human disciplines have authority by virtue of being true, no less may be claimed for Christian experience: there are doctrines which can be rejected simply because they do not accord with it (Lane 1994, 321).

7 The essence of *sola Scriptura* is that Scripture is the final authority or norm for Christian belief.

This is well expressed in Article 1:10 of the Westminster Confession:

> The supreme Judge, by which all controversies of religion are to be determined, and all creeds of councils, opinions of ancient writers, doctrines of men, and private spirits, are to be examined, and in whose sentence we are to rest, can be no other but the Holy Spirit speaking in the scripture.

To quote Lane once more:

> Stated differently, *sola Scriptura* is the statement that the church can err ... In the words of the traditional formula, Scripture is the *norma normans non normata*, the norm or rule that rules but is not itself ruled. (Lane 1994, 324)
>
> *Sola Scriptura* asserts the supremacy of the text over its interpreter. Of course, Scripture needs to be interpreted, but it does not need a normative interpretation. (Lane 1994, 326)

As Lane goes on to acknowledge, this raises the issues of the perspicuity or clarity of Scripture, and its hermeneutical self-sufficiency (Scripture is its own interpreter). The essential response here is that even though modern study and the cultural relativity of all language complicate the process of interpretation, the Word of God as it is communicated in Scripture remains the final judge of all teaching in the church. 'This is a (arguably the) fundamental principle of the Reformation' (Lane 1994, 326). To quote Grogan:

> A Bible bereft of hermeneutical principles whatever would be like a chest full of great treasure to which nobody possessed the key.
>
> What the Reformers really stood for was the fact that the Bible contains the basic principles by which it is to be understood. These principles of interpretation are therefore just as much 'given' as is the doctrine of inspiration itself. In relation to hermeneutics, this is true both at the grammatico-historical and the theological levels of interpretation. (Grogan 1997, 208)

In saying this, he recognises the very issues Lane identifies with regard to sources and resources of possible hermeneutical value.

To summarise, then, *sola Scriptura* does not imply that Scripture is the sole source or sole resource, but rather the supreme source: neither does it imply that Scripture is the sole authority, despite rhetoric on the part of some to this effect. For the Reformation, and for Protestant and evangelical theology, Scripture is the supreme source and the final authority (cf. Lane 1994, 327).

This applies to the position of Scripture with reference to reason and scientific knowledge. However, it is worth noting that, as Lane's analysis shows,

> it is not in fact in this context that the *sola Scriptura* principle is invoked. ... The relation between Scripture and human reason or natural human knowledge raises questions about the authority and reliability of Scripture. But these debates are not the context of the Reformation *sola Scriptura* principle and they are not especially forwarded by it. (Lane 1994, 326)

Grogan acknowledges that the *sola Scriptura* element in Reformation theology was historically conditioned, and that we should not indulge in over-rigorous application of the sufficiency principle. He balances this by warning of the danger of reading Scripture without self-criticism:

> Without letting it exercise a paralysing influence on our necessary hermeneutical task, we should do well to take seriously the question of Berkouwer, when he asks, 'Do we hear in God's Word that which we already know, that is, the images, feelings and presuppositions of our own hearts?' Much depends on our facing this question with honesty. (Grogan 1997, 221)

'That which we already know' (or think we know) can apply as much to fundamentalism in the worst sense[6] as it can to excessive confidence in science as an autonomous bearer of truth.

Conclusion

In the light of this analysis, we may offers some closing comments on the perspectives of Blocher and Lucas.

While Blocher's invocation of the Reformation slogan perhaps needs to be qualified and nuanced, his emphasis should be heeded when particular scientific theories are allowed to have excessive influence in biblical interpretation.

Lucas's approach opens the door to such influence when he rules out particular interpretations of Scripture on scientific grounds (in flat contradiction to Blocher). To the extent that Lucas perceives science as independent from, parallel to, and unregulated by Scripture, his approach is more problematic and less convincing than Blocher's—however much Lucas might affirm that 'science explores God's truth' (cf. Lucas 2001, 23–26, 60–63). Furthermore, 'truth' in relation to 'science' is an important issue, requiring analysis which is beyond the scope of the present discussion.

Blocher's general approach, then, is to be preferred, as one which is properly evangelical.[7] It should not, however, be used to justify undue dismissal of the scientific enterprise, and it does not imply that we will never revise our understanding of the Bible in the light of genuine discoveries.[8] When necessary, it does imply the need for rectification or reformation of presuppositions or ideologies which influence interpretative frameworks.[9]

Hasel's counsel is wise and pertinent here:

> Scripture, if it is to maintain its own integrity, can hardly be interpreted in such a way as to be accommodated time and again to any kind of interpretation derived from science, sociology, history, *etc.* Scripture, based on its own nature and authority, has its own integrity of meaning and its inherent truth claims. They emerge ever more clearly on the basis of a careful study of the Bible with sound methods of interpretation which are in harmony with and rooted in the testimony of Scripture itself. This implies that Scripture's authority resides in itself; it is based in revelation and grounded in inspiration.
>
> The self-sufficiency of Scripture of which we have spoken does not mean that any question raised from other areas of investigation such as science, history, sociology and so on cannot be discussed with reference to Scripture. But there is a vast difference between asking new questions of Scripture and superimposing meaning on Scripture. (Hasel 1994, 10)

This difference does not always appear to be appreciated by those who seek to re-examine the Bible in the light of the contemporary scientific consensus (for example, some theistic evolutionists), and this betrays an inadequate grasp, or application, of the *sola Scriptura* principle. A reaction to this (by, for example, some creationists) which amounts to a crusading, heavy-handed or naïve application of the principle does no more justice to its nuances, and is equally unsatisfactory. Triumphalism, whether it arises from scientism or fundamentalism, however well-meant, is unwise and inappropriate. Regrettably, both tendencies may still be discerned in the assertions of some commentators on 'the Bible and science'.

As Blocher warns, a fideistic separation between 'science and faith' betrays the biblical understanding of truth. Such an understanding comes within the orbit of *sola Scriptura* properly understood, and should undergird our exploration of truth in the Bible itself, in the Saviour's church and in the Creator's world.

Notes

1 We 'cannot have too much help from lexicographers, grammarians, experts in semantics, stylistics, history and historical background, even the human sciences in so far as they are sciences and not, by their ideology, *too* human' (Blocher 1984, 18). For example, archæology of the Ancient Near East, the Dead Sea Scrolls and Greek papyri discovered in Egypt have all contributed significantly to our understanding of the Bible.

2 Fideism is the view that certain beliefs (particularly religious ones) must be accepted by faith, apart from the exercise of reason (which is misleading or incapable).

3 'Formal' and 'material' are scholastic terms, which can be understood as distinguishing between form (in this case, how is doctrine established?) and content (what are the essential doctrines?).

4 As Paul recognizes in Romans 1 (Grogan, 1997 p.217).

5 Preliminary remarks or analysis.

6 So, 'though fundamentalists cry "Back to the texts themselves!" in reality they tend to confuse the text with their way of reading it ... *Fundamentalism thus preaches the authority of the text but practices the authority of the interpretive community* ... The irony is acute and painful' (Vanhoozer, 1998 p.425, original italics).

7 This need not imply acceptance of Blocher's own detailed exegetical conclusions in his handling of early Genesis.

8 For example, 'the discovery of the Dead Sea Scrolls may lead Christians to revise their interpretation of certain biblical passages. To do so is not to make one's allegiance to the literal sense of Scripture secondary, but rather to express one's allegiance to the text rather than to the traditon of one's interpretation of it' (Vanhoozer, 1997 p.149).

9 *Cf.* Blocher (1984) 24, 231. For fuller discussion, see my *Reading the Mind of God: Interpretation in science and theology* (Duce 1998), particularly chapters 5 and 6. The present essay serves to bring some necessary nuance to, and expansion on, the comments on p.74 of that volume.

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For Editorial comment, please see inside back cover.

Can Darwinism explain Features classed as Irreducibly Complex?

David Tyler

FOR 140 years, Darwinists have promoted the concept of step-by-step incremental change of organisms, with each new variant acted on by natural selection, leading to the origin of new species, genera, families, classes, orders and phyla. Richard Dawkins has adopted the metaphor of 'climbing Mount Improbable'. 'What might seem an absurd ascent when viewed from below the sheer cliff face of the mountain, is understood to be straightforward when we come to realise that there is a continuous path from the base to the peak.'

Then, in 1996 came Mike Behe's biochemical challenge to Darwinian gradualism. In 'Darwin's Black Box' (reviewed for *BCS* by Tyler, 1997), the concept of irreducible complexity was developed in the context of biochemical pathways for cellular activity. Behe recognised that Darwinists cannot demonstrate a continuous pathway for evolutionary change, and they effectively support their case by reference to a 'black box' of hypothetical gradual transformation. However, biochemists have been opening the black box at the level of cellular chemical reactions: and here the complexity of living things is revealed to be astounding. According to Behe, irreducible complexity occurs wherever there are well-matched interacting components of a system and where the loss of any of these parts leads to a loss of functioning of the whole system. In such cases, he argued, gradualistic assembly explanations are inadequate and the only examples we have of irreducibly complex systems are those involving intelligent design.

Behe's argument has resisted all attempts to undermine it (and there have been many). Thornhill and Ussery (2000) introduce their article by saying 'a common argument used by anti-Darwinians involves the difficulty of explaining the origin of complex structures by [step-by-step gradual processes]' They attribute the term 'irreducible complexity' to Behe. Their paper sets out to 'classify the different possible routes of Darwinian evolution' and to ask which of them can yield irreducibly complex structures.

Four fundamental routes of Darwinian evolution are identified. These are:

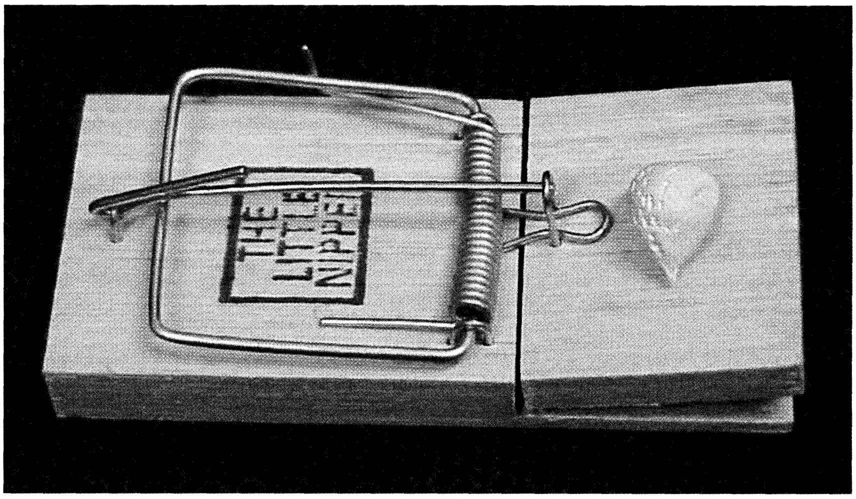
1. *Serial direct Darwinian evolution* ('change along a single axis').
2. *Parallel direct Darwinian evolution* (involving 'approximately synchronous changes in more than one component').
3. *Elimination of functional redundancy* (a route whereby one complex structure can change into another complex structure).
4. *Adoption from a different function* (a route whereby one complex structure switches function and continues as a complex structure with a different role in the organism).

Most of the paper provides elaboration on these four routes.

Serial direct Darwinian evolution gets only one paragraph. The most significant sentence is: 'Although it can generate complicated structures, it cannot generate irreducibly complex structures.' This remarkable admission should not be passed over quickly, because all the text book examples of Darwinian evolution are serial direct. These include the Galapagos finch beaks, the U.K.'s peppered moth, the Caribbean lizard legs, the fossil horse morphologies and so on. Students equipped with these evidences of variation in living things have nothing that they can use to respond to arguments from irreducible complexity.

Parallel direct Darwinian evolution gets two paragraphs. The main conclusion is that 'Parallel direct Darwinian evolution can generate irreducibly complex structures, but not irreducibly complex structures of functionally indivisible components.' Whatever the first part of the sentence may mean, it is the second part that relates to Behe's use of the term irreducible complexity. Behe has shown that many biochemical systems have functionally indivisible components and, as a consequence, this second route for Darwinian transformation cannot deliver irreducible complexity.

Elimination of functional redundancy is discussed by reference to the evolution of the mammalian jaw from the



The mouse trap, used by Behe to explain the concept of irreducible complexity. Removing any one of the elements makes the system useless.

reptilian jaw, without demonstrating that either are irreducibly complex. There is no attempt to relate the argument to the molecular machines discussed by Behe. Even if we accept the conclusion, that 'redundancy elimination can generate irreducibly complex structures of functionally indivisible components', the problem is that we start and finish with irreducible complexity. This mechanism has not been effective in demonstrating how the complexity could arise in the first place.

Adoption from a different function starts by considering the sequence from reptilian scales to avian feathers. Although insulation may have driven the change, the ability to fly emerged as a significant selection factor, and the function of flight was adopted in preference to the function of insulation. Again, there is no attempt to relate these arguments to Behe's biochemical challenge, and we are left wondering whether the examples discussed really exhibit irreducible complexity. Nevertheless, accepting the conclusion that adoption from a different function is a route to irreducible complexity, we must note that, again, the starting point is a complex, as distinct from a simple, system. Furthermore, since adoption is essentially a matter of contingency, this mechanism does not conform well to the Darwinian desire to associate evolutionary change with the action of selection pressures. If Mount Improbable is to be climbed, Darwinists expect a pathway up the slope. They do not like to think that, were it not for some fortunate contingency, the Mount would never have been conquered.

Whilst Thornhill and Ussery have attempted to set out a framework for better understanding of the term irreducible complexity within a Darwinian model of evolution, they have actually exposed some serious problems within neo-Darwinism. By showing that neither the serial direct nor the parallel direct routes can lead to irreducible complexity at the biomolecular level, they effectively acknowledge that none of the accepted evidences for evolutionary transformism are capable of meeting this challenge. Since the other options identified start with as much (or more) complexity than is present at the finish, these routes do not address the problems either.

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Learning from Nature

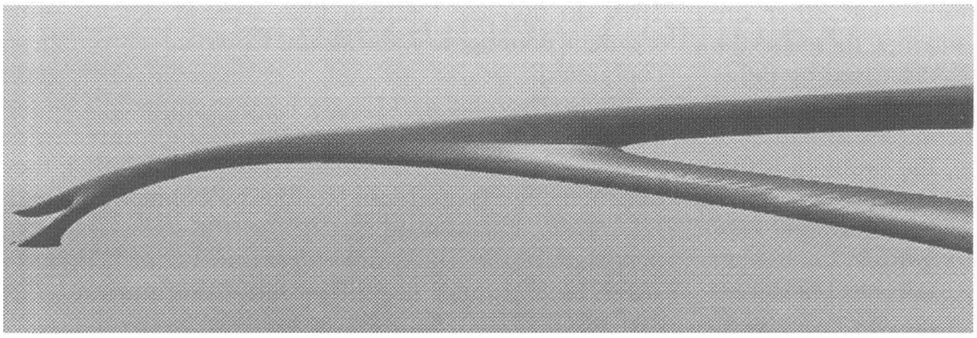
Stuart Burgess

THERE have been recent reports of engineers and architects planning to copy some of the design features of bones and skeletons in order to produce more efficient and aesthetic structures for bridges and buildings (Sample, 2000: Nsugbe and Williams, 2001). D'arcy Thompson (1961) was one of the first scientists to describe optimum design in natural structures like skeletons and his book *On Growth and Form,* which was first written in the early twentieth century, has become a classic text on the subject. In fact, there is now a whole subject area called 'biomimetics' (mimicking of biological systems). I am responsible for teaching this subject at Bristol University to engineering students.

Some of the optimum structural features of bones are as follows:

1. Their overall form is such that they have a very uniform stress distribution and therefore little redundant material. For example, the limb bones of mammals are narrow away from the joints but they thicken out near to the joints because stresses are higher in these regions.
2. Bones also have detailed features that help to create an efficient structure. These features include hollow section tubes (birds) or low-density inner cores (mammals). Some birds even have cross bracing inside some of their bones (vultures).
3. When bones experience high local stress, they respond by growing more cells in those areas. This means that bones grow in such a way as to produce an equal stress distribution.
4. Bone material has a very high strength to weight ratio.

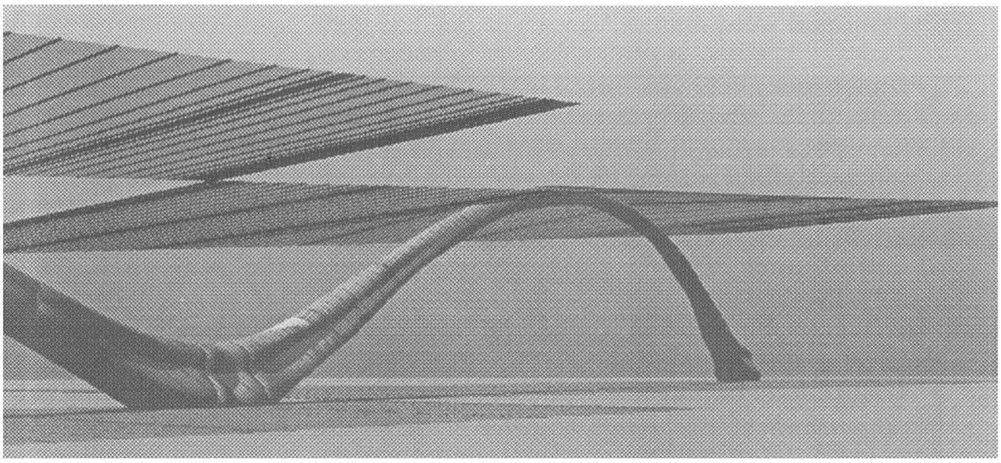
In mammals, not only are bones excellent structural components in themselves, but they also form part of a musculo-skeletal system which is a very efficient and sophisticated structural system. In particular, the bones and ligaments form complex structures where the bones represent compression members and the ligaments represent tension members. For example, the neck of the



horse represents a cantilever truss structure where the compression members are formed by the vertebræ and intervertebral discs and the tension members are formed by the ligaments, tendons and bones. As well as having a very efficient structural design, bones and skeletons are very curvaceous and elegant in form. The structural efficiency and elegance of bones and skeletons make them ideal for engineers and architects to copy.

The copying of designs from nature raises three serious problems for evolutionists:

1. Engineers acknowledge that natural structures are superior to man-made ones, but according to evolution this should not be the case.
   Steven Vogel (1998), who is a leading expert in biomimetics (and who is also an evolutionist) has admitted that: 'evolution faces constraints far higher than anything impeding human designers'. The logical outcome of this very true statement is that natural designs should be inferior to human designs. The desire to copy nature by engineers and architects is an important evidence for creation!



2. It is often impossible to evolve one type of structure from another type of structure. Secular scientific publications have presented various examples of this (Birmingham, 1994 and Caldwell and Woodhead, 1973). For example, it is impossible to evolve a circular hollow section beam into a truss structure by step-by-step change because the two structures are defined by completely different variables. This result provides great evidence that truss structures in nature, such as the metacarpal bone of the vulture, were created as fully functioning structures.
3. Bones have functions other than supporting loads. Bones not only support the body and make joints, they also perform a vital function in the blood system. The bone marrow within bones produces red blood cells for the blood at a rate of 1.5 million cells per second with every single cell containing 250 million molecules of hæmoglobin! Even though he was not a creationist, D'arcy Thompson (1961) used the example of the complexity of the human body to make severe criticisms of Darwinian evolution. In the foreword and introduction to this book, *On Growth and Form*, Stephen Jay Gould and the editor try in vain to explain away these criticisms.

It is interesting to note that in the field of genetic engineering there have been no reports of scientists planning to instil into an organism a design feature that has been conceived uniquely by human designers.

It is very difficult for the evolutionist to explain how on the one hand the process of evolution is severely restricted compared to intelligent design, but on the other hand nature contains designs that are far more advanced than those produced by human designers.

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ACKNOWLEDGEMENT

The illustrations appear in Nsugbe and Williams (2001) paper and are used by permission.

Look out, that Mountain is Moving Fast!

Michael Garton

AN ENORMOUS block of rock? As big as Lancashire? Moving 25 miles across America? And moving fast? These are surprising—and well supported claims recently made for slide blocks in the prestigious journal *Geology* (Anders, 2000).

To understand what a slide block is we need to start by thinking of avalanches of rock thundering down a quarry or mountainside. We know they move quickly as a chaotic jumble of boulders. Slide blocks are different, and rather puzzling. Although they are much bigger and move further than avalanches, layering in them remains coherent, not fragmented and chaotic. They do move down hill, but on such low angle slopes I would not even notice the incline on a bicycle.

How can a large mass of rock move many miles without breaking up? The obvious, and usual answer for slide blocks has been, 'They move very, very slowly.' Debate has continued for more than fifty years over one large slide block in Wyoming; some evidence suggested the Heart Mountain detachment moved more than 25 miles 'in a matter of hours'. By studying the gliding surfaces, including at Heart Mountain, Anders, Aharonov and Walsh (2000) claim to be able to identify how such glide blocks move, and show they moved fast.

From experience—at some time we have all tried to move a heavy item of furniture—if they are going to move at all then enormous blocks of rock need some special mechanism to eliminate friction. Lift generated by high pressure water (more rarely gas) has usually been invoked to make sliding possible. Now Anders *et al*.(2000) recognise a new process—once movement starts then it is maintained by a thin and continuous, highly agitated bed of 'fluidised grains'. This sort of fluidisation demands rapid movement; paraxodically the larger (heavier) the mass that has to move, the faster it must go to develop sufficient lift from fluidisation. All the displacement takes place at once, for the authors describe delicate but unbroken, fossilised wood astride some movement surfaces. Also, there has been a single phase of fluidised grains invading the surrounding rock—there are no early phases of veining cross cut by later phases.

I think their evidence for movement supported by grain fluidisation is good. Creationists will stand in awe of, but be pleased to affirm, the possibility of 'a rapidly moving rock mass during a single catastrophic emplacement event.' Remember the literature is now accepting that rocks masses extensive as Lancashire moved tens of miles in a few hours—or less!

I suggest that Anders and his co-workers have begun to unlock the awesome testimony of these slide blocks—but there is another creationist alternative. At Heart Mountain, some Carboniferous limestone has slid on to Tertiary limestone. Clifford Burdick (1977) failed to grasp the bigger picture; for him the prize was the apparent reversal of the order of fossils.

Sketch of a train crash to illustrate the difference between an avalanche (which is familiar to us) and the much bigger structures which make mountains. The two loose trucks represent slide blocks; new evidence shows they move rapidly, not slowly over thousands of years.

If slide blocks move rapidly then this, Anders and his co-workers could have prepared the way for more radical—and awesome—thinking in the literature. The train diagram puts slide blocks into a wider context.

Glass from the broken window has fallen onto the ground—equivalent to an avalanche. Two trucks have broken free from the mayhem, one has slid across the top and the other along the rails in front. These would be analogues for slide blocks discussed here. But what of the other trucks? These have not broken free, and represent the squashing and overthrusting seen in mountain belts.

Before the publication we are discussing, most geologists would have said that movement in the 'mountain belt' crept along very slowly. But slide blocks are closely related to overthrusting in mountain belts. If slide blocks move rapidly, is this also the case for overthrusting? Although slide blocks are uncoupled from overthrusts, the answer must surely be yes, individual overthrusts also move quickly. After each pulse of movement on an individual overthrust, there is usually a pause with erosion of the newly overthrusted material, before another rapid pulse. Since the sedimentation is often demonstrably rapid, even catastrophic (Garton, 1997) we ought to anticipate some exciting developments in the professional literature. Will creationists lead the way? We ought to—and what a frightening testimony awaits to be told!

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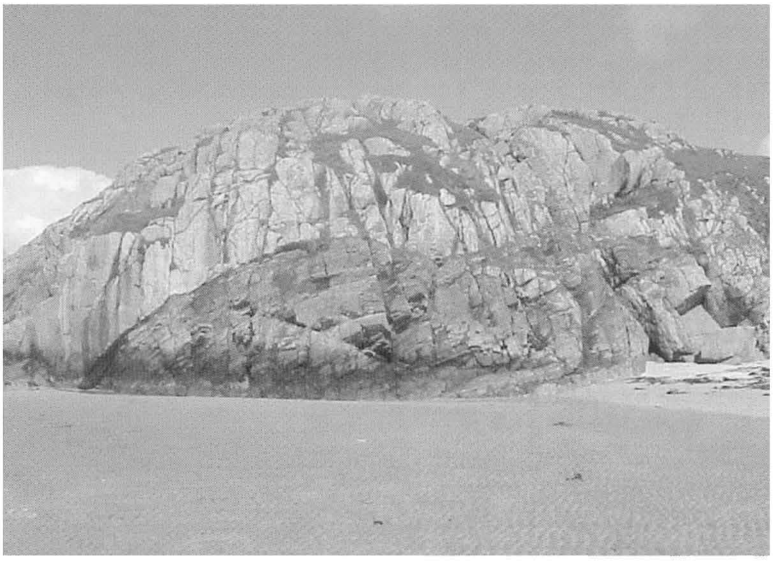
Granite up to Speed

David J. Tyler

THE PAST decade has seen a transformation in thinking about granitic rocks. The textbooks need radical revision. Gone are the millions of years for the formation of these rocks; gone are the diapirs (spheroidal magma bodies) that rise from the depths of the crust to their position of emplacement; and gone are the innumerable models of granite bodies that portray them as components of massive batholiths with enormous roots.

Petford *et al.* (2000) have provided an excellent review of current thinking on the formation, transport and emplacement of granites. They comment that the earlier views emerged from the use of geochemical and isotope studies, but the past decade has seen a focus on physical processes. 'As a result, dynamic models that operate on timescales of months to centuries are replacing the once-prevailing view of granitic magma production as a slow, equilibrium process that requires millions of years for completion.' (p.669).

Earlier views of granite generation have majored on the concept of partial melting and fractional crystallisation. These models have foundered, in part, on the need to have partial melting of enormous volumes of mantle rock just to generate a small granite pluton. The newer views are based on local melting of the lower crust by the intrusion of hot basaltic magmas. 'Partial melting of crustal rocks pre-heated in this way is likely to be rapid, with models predicting a melt layer two-thirds the thickness of the basaltic intrusion forming in 200 years, at a temperature of up to 950C.' (p.669).



Stoping in the Ross of Mull intrusion. The large block of dark rock has been caught up with the granite and is being assimilated. Stoping no longer needs to be regarded as a mechanism for creating space for magma intrusion.

Associated with this melting is a large positive volume change that produces local fracturing and enhanced permeabilities. The consequence is rapid melt segregation (Box 1). The viscosity of granite melts has been revised downwards as a result of recent research, and if water is present at 3–5%, the viscosities are significantly lower. Estimates of segregation time vary from 0·1 –10,000 years, depending on water content and deformation pressure.

Ascent is driven by gravity, but modern thinking has moved away completely from huge diapirs and the stoping mechanism (Box 2). Now, the focus is on tectonic control, with a variety of dyke/conduit ascent models. 'One of the most striking aspects of the ascent of granitic melts in dykes compared to diapiric rise is the extreme difference in magma ascent rate between both processes, with the former up to a factor of 10^6 faster depending upon the

1

Melt segregation: a process whereby molten material separates from unmolten enclosing rock and forms a fluid which can migrate upwards.

viscosity of the material and conduit width.' (p.670) 'Dyke ascent models also bring plutonic granite magmatism more in line with timescales characteristic of silicic volcanism and flood basalt magmatism.' (p.670)

Emplacement has engaged the attention of all granite researchers. The 'space problem' has never been solved satisfactorily using traditional models. For example, rocks surrounding the plutons do not show the types of deformation that would be expected if they were forced aside by rising diapirs.

In the new model, emplacement is the transition from upward to lateral flow of granite. The majority of plutons have a lenticular shape. 'Such multidisciplinary investigations again show that the common form is sheet-like as do the few detailed seismic surveys so far undertaken over or through granite batholiths.' (p.671).

The model involves a series of granite intrusions, building up the volume of granite at the emplacement site step by step. This is 'consistent with an increasing number of field studies that find plutons to be internally sheeted on the decimetre to kilometre scale.' (p.671).

2

Stoping: describing the way a large magma body, or diapir, moves upwards through higher crustal levels by removing blocks of rock from the roof of the chamber and then assimilating them in the magma.

Timescales for emplacement have been estimated. Using 'conservative values' for parameters, and taking a range of filling rates, 'places lower and upper bounds on pluton filling times of less than 40 days to more than 1 Myr for plutons less than 1 km to more than 100 km.' 'The rate-limiting step in granite magmatism is the timescale of partial melting; the follow-on stage of segregation, ascent and emplacement can be geologically extremely rapid – perhaps even catastrophic'. (p.673).

These new views certainly create new research challenges. If granite formation is the result of crustal melting, the problem remains as to how the continental crust formed in the first place. Whether or not this problem is intractable, biblically-oriented geologists will want their thinking to be informed by biblical revelation about land formation on the Third Day of Creation Week. Another research challenge relates to radiometric dating of plutons and associated mineralisation. Generally, these results have supported the traditional views: granite emplacement over millions of years. However, such trends fit less well into the new picture. It is likely that the trends will be reinterpreted either as a geochemical phenomenon, or as the results of human bias in the handling of isotopic data.

It will take some time for the new ideas to feed back into research and into the textbooks. However, granite formation concepts have moved a long way from their traditional roots (involving long timescales) towards dynamic, relatively rapid and potentially catastrophic processes. The new thinking is entirely compatible with catastrophist views of earth history and with some Diluvialist models.

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Petford, N. and Clemens, J. D. (2000). *Granites are not diapiric!* Geology Today, 16 (5) pp.180–184.

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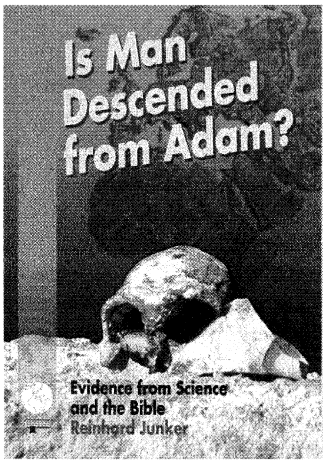
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Book Reviews

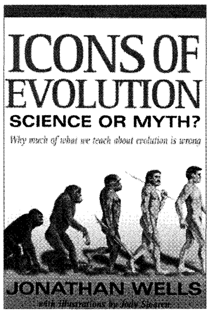
Icons of Evolution. Science or myth?
Jonathan Wells
Regnery Publishing, Inc., Washington. 2000.
ISBN 0–89526–276–2

Reviewed by David Tyler.

According to a recent survey, twelve of the most popular science textbooks used in US schools are riddled with errors. The investigation was funded with a $64,000 grant and took two years to complete. According to the lead researcher: 'The books have a very large number of errors, many irrelevant photographs, complicated illustrations, experiments that could not possibly work, and drawings that represented impossible situations'. (Associated Press, 2001). There is no evidence that there has been an intention to misrepresent science. The errors appear to be random.

In the main, the study has been given a positive reception, although a few publishers have considered the complaints trifling and dismissed them.

By contrast, a few months previously, a book appeared that examined ten U.S.A. textbooks used in contemporary pre-university and university biology courses. All the textbooks have copyright dates of 1998 or later. The book examines the ten most widely used evidences supporting the theory of evolution. It concludes not only that there are errors, but that the errors are of a far more serious nature. It maintains that the textbooks are misrepresenting the scientific evidence; that the misrepresentations serve to promote a particular theory of evolution (neo-Darwinism); and that in some cases there is an explicit advocacy of materialistic philosophy as being the essence of science. This study did not receive a grant despite its potential importance. Far from there being a positive response from evolutionary biologists, the book has been given a hostile reception and numerous critical reviews have been published.



At the outset of the book, Wells reminds his readers of the truth-seeking aim of science and the way this translates into the testing of theories by evidence. Most scientists like to think that their work can be understood and appreciated by intelligent people, and Wells has written his book with the same expectation. There is a problem, though, regarding the word 'evolution'. Some have used it to mean 'variation' or 'change over time', but this is confusing. The textbooks are advocating Darwinian evolution, which extrapolates today's observations of 'descent with modification' to deliver an explanation of the origin of all living things. Since 'variation' is compatible with other explanations of origins besides Darwinism, it cannot be regarded as having a meaning synonymous with large-scale evolution. This basic confusion over terminology appears to be a very significant problem with the textbook presentations of the subject.

Wells examines the most popular ten evidences used in U.S.A. textbooks to support Darwinian evolution (based on the arguments presented in the textbooks). All of them are associated with visual images—to assist students assimilate the material. Wells's argument is that these visual images, the icons of evolution, are consistently misrepresenting the truth. The reality is that the evidences are either contrary to Darwinism or, at least, ambivalent to it, so that they cannot be used with integrity as evidence for the theory. He regards this situation as scandalous and an indictment of the educational system and those members of the research community that condone it. Wells's ability to put his finger on the deficiencies and his unrestrained call for an open revolt against the Darwinian Establishment in science goes a long way to explain the hostility generated by this book.

The ten icons are:

1. The Miller-Urey experiment simulating the Earth's primitive atmosphere with electrical discharges generating some of the building blocks of life;
2. The evolutionary tree of life in which the first living cell evolves into the diversity we see today;
3. The phenomenon of homology, in which similar bone structures in vertebrates are used as evidence for a common ancestor;
4. Illustrations of early-stage embryos which are declared to be very similar and supportive of the idea that all vertebrates evolved from fish;
5. Transitional species, notably *Archæopteryx*, that are said to be links in evolutionary transformation;
6. Industrial melanism in the peppered moth which is the classic example of 'natural selection in action' and an essential element of Darwinian theory;
7. The Galápagos finches, of historical importance for the development of Darwinism;
8. Fruit flies with an extra pair of wings, demonstrating the potential for mutations to achieve transformation;
9. Horse evolution, long used to show the directed nature of evolutionary change but now regarded as refuting this idea;
10. Human evolution, with a very strong iconography of ape-men bridging the gaps between humans and the apes.

Each icon is allocated a chapter to document the significance of the original research and to review subsequent work that expands and develops the evidence. These chapters are about twenty pages in length and each is supported by about seven pages of research notes. Despite the wide-ranging nature of the topics, the text is well-written and informative throughout. For a contemporary critique of the major evidences used to support Darwinism, the book is unsurpassed.

The best of the critical reviews that I have read comes from the pen of Larry Martin (2001), professor of ecology and evolutionary biology and curator of vertebrate palæontology at the University of Kansas. Martin is a highly respected academic whose views I also treat with respect. I was particularly struck by this comment: 'Politics aside, Wells is a good writer who lays out his arguments clearly and is factually accurate ... If Wells made a technical error, I missed it'. It is very unusual to have a tribute like this: indeed, many other reviewers have felt it necessary to demonstrate faults with Wells's library research, but what they come up with reflects badly on their own grasp of the issues. Wells has succeeded in bringing relevant evidences to his readers; the next step is to realise that, in the main, scholars disagree because they attribute different meanings to the same evidences.

The point missed by reviewer after reviewer is that the textbooks convey little or nothing of this legitimate debate about the meaning of evidences. Students are being presented with pre-packaged research findings that are declared to support neo-Darwinism, the establishment orthodoxy regarding evolutionary theory. When the evidences are manipulated (as is certainly the case with Haeckel's faked embryo drawings and with the photos of peppered moths resting on tree trunks), the self correcting nature of science is so sluggish that it can hardly be recognised as such. When the evidences are hostile to Darwinism (as is clearly evident in the cases of the evolutionary tree of life, the extreme rarity of transitional forms, and the effects of mutations on fruit flies), the evidences are force-fitted into the 'establishment' position without doing justice to any alternative perspectives. Even if scholars are convinced that neo-Darwinism is correct, this cannot justify the use of weak arguments, selective reading of the data or the continuing use of erroneous material. For the sake of sound educational practice, reformation in the teaching of evolutionary theory is urgent.

Wells has been criticised for including the Miller-Urey experiment in the book. Martin writes: 'I am a bit puzzled why this chapter was included, as the origin of life does not seem to be an evolutionary question'. The initial response must be, of course, the pragmatic one that all ten biology texts have the icon. Why is it considered important that biologists are exposed to these ideas? Wells shows that the issues are very much to do with a naturalistic perspective in science: 'nature is all there is'. Why do biology textbooks think it necessary to include a section that advocates, or at least reports uncritically, research on abiogenesis? The inference that Wells makes is that the textbooks have a hidden philosophical agenda and that science is being redefined in purely naturalistic terms. In scientific circles, it is perceived necessary for the textbooks to develop an explanation of origins that is rooted in natural causation and which is closed to considering any alternatives to this. This philosophical position effectively turns science into a slave: where an open spirit of enquiry is supplanted by an ideological straightjacket. That such a straitjacket exists is, of course, amply demonstrated in the chapters on the ten icons.

Icons of Evolution is a powerful critique of both Darwinism and the educational system that is being used to underpin the theory. The book does not set out to present an alternative explanation of origins, so it would be quite wrong to criticise Wells for this 'omission'. *Icons* calls for honesty and integrity in teaching, research and debate. Friends of education will welcome the book and will want to see the contents widely discussed. For too long, Darwinism has 'won the argument' by default—because its advocates have discredited the dissidents. With Wells's well-researched book, this situation must not be allowed to continue.

References

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The Triumph of Evolution and the Failure of Creationism.

By Niles Eldredge.
Freeman, 223pp., £18.99. IBSN 0 7 167 3638 1.

Reviewed by Alan Linton.

This book was written to defend the theory of evolution against the powerful and influential anti-evolution lobby of creationists in the United States who wish to ban the teaching of evolution in science curricula in schools and colleges. It is an up-to-date examination of the evolution–creation debate and provides a useful review of arguments on both sides.

After setting the scene (religious, scientific and political), Niles Eldredge devotes three chapters to considering the evidence for evolution: that all life has descended from a single, common ancestor, that there is a record of that evolutionary history preserved in the rocks and that the driving force behind evolution is natural selection combined with dramatic ecological and physical catastrophes resulting in the extinction of large groups of animal and plant species.

Throughout, the author scathingly ridicules creationists and this intensifies in chapters 5 and 6 where he tackles their views head-on under the titles, 'Scientific style and notion of time' and 'The origin and history of life'. In the final chapter, 'Can we afford a culture war?', he adopts a more conciliatory approach, urging evolutionists and creationists to drop their antagonisms and focus on the urgent need to stem the tide of ecosystem destruction and species loss to preserve a long and fruitful existence on this earth.

Despite the conciliatory comments in the final chapter, the book's title is essentially emotive and provocative. Since most theories, if proven to be false, are rejected by scientists, Eldredge claims that, after 150 years, science has failed to disprove the theory of evolution and, therefore, 'evolution has triumphed'. In other words, the theory of evolution rests on the failure of science to show that it is false. Nevertheless, he believes the theory can be scientifically tested.

But where is the experimental evidence? None exists in the literature claiming that one species has been shown to evolve into another. Bacteria, the simplest form of independent life, are ideal for this kind of study, with generation times of 20 to 30 minutes, and populations achieved after 18 hours. But throughout 150 years of the science of bacteriology, there is no evidence that one species of bacteria has changed into another, in spite of the fact that populations have been exposed to potent chemical and physical mutagens and that, uniquely, bacteria possess extrachromosomal, transmissible plasmids. Since there is no evidence for species changes between the simplest forms of unicellular life, it is not surprising that there is no evidence for evolution from prokaryotic to eukaryotic cells, let alone throughout the whole array of higher multicellular organisms.

The author rejects the creationists' arguments for order and design in nature but the extreme complexity of structure and function in all living things cannot be disregarded. The biochemical complexity of cascades of enzymes required to perform a single function in the cell is mind-boggling, and for a structure or function to be selected it must be functionally complete. The formation of amino acids from ammonia and methane under extremes of pressure and temperature is quoted, but this synthesis is nothing compared with the complexity of a single protein enzyme, let alone a series of highly specialised enzymes functioning in a cascade sequence. Such irreducibly complex systems are of no selective value unless they are complete. The author naïvely states that 'all biochemical steps leading to the formation of the first organism ... have yet to be deciphered'.

All creationists believe in a Creator but often hold divergent views on biblical interpretation. They include leading research scientists, past and present, who find the theory of evolution to be scientifically untenable; the natural world bears the hallmarks of order and design by a Great Intelligence. The astronomer Kepler confessed, 'O God, I am thinking Thy thoughts after Thee', and over the door of the Cavendish Laboratory in Cambridge is written, 'The works of the Lord are great, sought after by all them that have pleasure therein' (Psalm 111.2). The natural world is worthy of our finest investigations, and is in my view the expression of a Master Mind.

Evolutionists, creationists and educationalists planning curricula for teaching science will read this book with interest. But they should keep an open mind on whether the title is justified by the evidence provided.

Alan H. Linton is emeritus professor of bacteriology, University of Bristol.

This review first appeared in The Times Higher Education Supplement and permission has been granted for this reprinting.

The Biotic Message: Evolution versus Message Theory, by Walter J. ReMine. Saint Paul, Minnesota: St Paul Science, 1993. ISBN: 0–9637999–0–8.

Reviewed by Arthur Jones.

This is not a book for the faint-hearted—over 500 pages of solid text full of deep and technical analysis. But it is unique and outstanding. ReMine's genius in this book is to give us an enlightening focus on the 'whole picture'. He does this by meeting head-on one of the evolutionist's most persuasive popular arguments: 'If there is a Creator, then why did he design life to look like evolution?' I must confess that I have probably tacitly accepted the truth of the assertion and sought to show that even though it might look like evolution, evolution fails as the explanation. I am sure I have been in good company! ReMine's approach is much superior. Having examined the assertion in comprehensive detail, he concludes that it is entirely false: life *has* been designed and *deliberately designed to thwart all naturalistic evolutionary explanations.*

ReMine's thesis—'Message Theory'—is that as well as being reasonably designed for survival, 'life was also designed to convey a message that tells where it came from. Life was designed to look like the product of a single designer, and to resist all other explanations of origin.' (p.465) 'This simple idea', he continues, 'explains the pattern of life in a straightforward, scientific manner.' (*ibid.*). The alphabet of the message is *similarity* and *diversity*: 'Similarity and diversity both have a role in the biotic message. Similarity makes life look like the work of one designer, while diversity makes life difficult to explain by naturalistic processes.' (p.37). Throughout the book ReMine follows two strategies. First, he scrutinises the claim that evolution is science, demonstrating that evolutionary theory has never predicted any of life's universals, any of the data patterns. 'The classic evidences for evolution never were valid—because evolution never predicted them. They were merely used as evidence against a designer.' (p.25). All evolutionists do is provide just-so stories after the event that give an evolutionary interpretation: 'Most any circumstance can be accommodated by evolutionary scenarios.' (p.149). Second, ReMine shows that 'On point after point, message theory correctly predicts the details of life.' (*ibid.*).

In Chapter 2, ReMine considers naturalism in science. Here he exposes the inconsistencies and double standards of evolutionary arguments and concludes that an argument from design is scientifically valid.

Chapter 3 considers the origin of life. ReMine surveys the field well, but evolutionists know that their case here remains very weak. The more that research uncovers unsuspected levels of complexity in even the 'simplest' contemporary organisms, the more evolutionists are forced to argue that the first organisms must have used different simpler systems: 'Evolutionists use the same basic argument for biomolecules, life, the Earth, and the universe itself. When a design is too improbable to form by chance, they claim there are an infinitude of other biomolecules, life forms, planets, or universes *unlike* ours.' (p.84). This approach is a standard defensive response (others call it the 'inflationary strategy'), but it is hardly science. At a very minimum it must be possible to test the suggestions, *i.e.* specific biomolecules *etc.* must be postulated. That *specification* is not forthcoming. This leads to one of the central contradictions that ReMine exposes. On the one hand, evolutionists argue that the biological universals (nucleic acids, left-handed, α-bonded amino acids *etc.*) prove common descent. But, on the other, they conclude that these features are too improbable for the early organisms to have had them, and so must be later additions, *i.e.*, they need not be a sign of common descent!

Chapters 4 to 6 deal with Darwinism: survival of the fittest, natural selection and Darwinian story-telling. The discussion becomes rather tedious, but is still fascinating. What ReMine exposes is the enormous 'smorgasbord' of competing and conflicting theories that comprise modern Darwinism. Evolutionists simply use whatever theory best fits the situation, but the resulting story-telling makes no testable predictions. Darwinism has become so plastic that it can conform to any data. It seems that every 'prediction' ever made by Darwinism finds at least one counter-example in nature. Darwinism has little trouble explaining them away (*e.g.* as only 'apparent') or in coming up with Darwinian explanations after all. Examples considered by ReMine include the re-appearance of species in the fossil record after disappearing millions of years before (p.151); asexual flowers that produce pollen and nectar (p.147), the inability of any multicellular organism to digest cellulose (152–153). In contrast ReMine argues that Message Theory neatly explains every example in one consistent way. Sexual reproduction is the classic example. It remains a major problem for evolutionists in that a sexual parent sends only half of its genes to each of its progeny whereas an asexual parent sends all its genes to each progeny. In the Darwinian struggle to pass on more of your genes to future generations than your competitors, asexual reproduction should become totally dominant. Darwinian speculations abound, of course, but, 'It is fair to say that the firmest and most plausible evolutionary theories predict that sex should be non-existent.' (p.205). On the other hand creationists do not face the same problem because a Designer can incorporate long-term benefits into life's mechanisms that natural selection can never notice. But that aside, sexual reproduction has the two features necessary for the biotic message: common throughout the world of life (the unifying message—one designer) and resistant to naturalistic explanation.

Chapters 7–9 and two detailed appendices deal with genetics and form a centrepiece of ReMine's presentation. He has no difficulty refuting the claim that modern population genetics supports evolution. The theorems of population genetics are quite useful for testing various origins scenarios, but they remain mathematical constructs that tell us nothing about adaptation, natural selection or evolution as such. The highlight of the discussion is chapter 8 on 'Haldane's Dilemma'. This is probably unknown to most biologists, yet is of critical importance. Haldane's work (published 1957) showed that long-generation organisms have not had enough time to evolve, because the cost of substitution is too high, even given the most favourable assumptions for evolution. 'Cost of substitution' is a euphemism for death, for the fact that the fixing of a new gene in a population requires the death of all those individuals that do not have it. ReMine shows that on the basis of current genetic models, a human-like population could substitute no more than 1,667 selectively beneficial nucleotides (p.217), or 25,000 neutral nucleotides (p.246) in ten million years. This is nowhere near enough to account for human evolution. Yet it is 'the trade secret of evolutionary geneticists' (p.253). ReMine deals at length with the various attempts to resolve the problem—including Dawkins's computer simulations—but judges them all to be woefully inadequate.

A large group of chapters (10–22, 24–25) deal with the broad area of systematics. This includes biological classification, and also such topics as fossils, embryology, vestigial organs, biogeography and molecular evolution. Despite the apparent diversity they raise the same issues of interpretation. ReMine's approach is now familiar. He again points out that there is nothing in evolutionary theory that allows evolutionists to predict any systematic patterns in the living world. The nested hierarchical patterns of modern classifications are often presented as an evolutionary prediction, but that is simply not so. If organisms were discovered with no similarities to any known life, evolutionary theory would have no difficulty in inventing scenarios to include them:

> 'What the theory says depends on the situation at hand. Evolutionary theory predicts nothing, not even a nested hierarchy. Rather, the theory adapts to data like fog adapts to landscape.' (p.350)

ReMine then examines the evolutionists' discussions in detail to demonstrate both the absence of real science and the way in which vague or ambiguous terminology is used to create an illusion of evolution. Let me give a detailed example drawing from ReMine's analyses. *Archæopteryx* is described as a *transitional* or *intermediate* form between reptiles and birds. This gives the impression to non-specialists that evolutionists have identified a fossil lineage joining a reptile ancestor to a bird descendant. But *Archæopteryx* is actually an enigma. *None of its traits are transitional.* Its feathers, for example, are as fully developed as those of extant birds; they are not (say) part scale and part feather. Then what about the forms it is said to link? *Reptiles* is not a specific form, but a very large grouping of forms. In fact, it is not a genuine, characterisable group at all, but an artificial construct [the technical term is *paraphyletic*—see pp.282–284]. The *Reptilia* simply includes those animals left when the birds and mammals are removed from the *Amniota* (vertebrates which have extraembryonic membranes in development). In other words reptiles are defined by the absence of mammal and bird characters, not by the presence of any diagnostic 'reptile' characters (of which there are none). This is a very important point because many large taxonomic groups (invertebrates, fish, amphibians *etc.*) are paraphyletic and so are very many fossil groups (partly because many fossil specimens are incomplete and fragmented). The ancestral groups of evolutionary scenarios are almost invariably paraphyletic. Paraphyletic groupings may give labels which are convenient for some purposes, but when brought into evolutionary presentations they create an illusion of knowledge where there is none. How, for example, can we demonstrate that *Archæopteryx* has descended from a group which has no diagnostic characters? Rather, to have a testable, scientific hypothesis, we must identify specific forms as ancestor and descendant; at the very least we must specify characterisable lower-level groups. The descendant group, Birds, is a genuine characterisable group and so doesn't present the same problems. Nevertheless, it is a diverse higher-level group: too diverse to justify a genuine evolutionary lineage. Again we must identify specific forms or at least lower-level, well-characterised groups. ReMine entertainingly documents the many tactics adopted by evolutionists to avoid admitting the universal absence of specific ancestors and descendants—and therefore the absence of genuine intermediates.

Optimal Design

ReMine has build a powerful foundation for a scientific case against evolution. He has also added some fine pieces of superstructure. It is a marvellous achievement. There are doubtless minor details which will require refining or revision, but there are two major areas that I would urge ReMine to reconsider. The first is one where—uncharacteristically—he concedes too much to evolutionists. Several times through the book he considers one of the most persuasive evolutionist arguments—the argument from imperfection (pp.25–28, 352–53 396–97). This is the appeal to 'odd', or 'curious' structures in nature that (it is assumed) a skilled Designer would never use. ReMine correctly points out that this is not an argument for evolution. He tirelessly reminds us that evolution makes no relevant predictions and can readily accommodate either perfection or imperfection. Instead it is purely an argument against a Designer, on the assumption that the structures in question are imperfect and non-optimal. ReMine rejects the argument, yet concedes the interpretation of the data. He does so by arguing that odd and curious designs are needed as proof that there is one Designer (shown by the distinctive quirks and imperfections), not many. In the light of all that we know of our Designer, both from Scripture and Christian history and from our present scientific knowledge of His world, I am convinced that ReMine is wrong. It is not a matter of 'either/or', but, as so often, of 'both/and'—both one Designer *and* optimal design.

There is an interesting parallel from creationist history. Before Darwin there was a fascinating creationist tradition that was eclipsed by the rise of Darwinism and is almost unknown today. This is the tradition of 'Newtonian biology'. These creationists argued that just as the physical world was covered by laws so was the world of biology. In particular they looked for universal laws in the developmental processes of organisms. They believed that only certain paths of development were possible, *i.e.*, those allowed by the relevant laws. In other words, only certain kinds of organism were possible. Interestingly, some of the structuralists (*e.g.*, Brian Goodwin and also, it seems, Michael Denton) who have developed this tradition today argue that the possibilities may not be much greater than the kinds of organism already known (living and fossil). Now given those developmental constraints, it would be perfectly unexceptional to argue that some resulting structures are sub-optimal, simply because nothing else is possible. However the Newtonian biologists assumed that the Designer would have arranged things so that every creation outcome would be optimal. For them it was 'both/and'. If we combine the insights of the Newtonians with those of ReMine then we can put forward the following working position:

1. Life was designed to look like the product of a single designer, and to resist all other explanations of origin. Crucial to this position is a critical interplay of similarity and diversity: Similarity shows that life is the work of one designer, while diversity makes life difficult to explain by naturalistic processes.
2. All the created design outcomes, whether of similarity or diversity, are optimal.
3. The design outcomes constitute a relatively narrow range of possibilities, set by the laws of biological development.

Taken together these hypotheses have enormous appeal. They create a research agenda that will keep generations of biological scientists fully occupied and they are highly testable, highly vulnerable to refutation. On the other hand their survival through rigorous testing will render their exclusion from mainstream science increasingly hard to defend.

One obvious proviso should be added. Creationists should, I believe accept the optimality of created design. However creationists also accept that this is a fallen, corrupted world. So we do accept that there will be instances of degeneration. However this is not a convenient 'opt-out' clause akin to the elasticity of the Darwinian 'just so' stories. I am convinced that there is only very rarely indeed any difficulty in recognising such degeneration and that the examples (blind cave animals, wingless flies on windswept islands, *etc.*) only reinforce the assumption of original perfection.

Challenging Biological Reductionism

This leads on to a second major area that I would ask ReMine to reconsider, that of genetics: that all of biological heredity is grounded in a chemical called DNA.

A number of facts strongly support an alternative paradigm: that the whole cell is a lawful developmental system. All organisms of a particular type have a developmental system capable of generating any out of a limited repertoire of possible forms. The gene/gene product system is the inbuilt (tightly controlled) mechanism for biasing the system in one way rather than another, but environmental shocks may have the same (uncontrollled) effects. Development cannot be reduced to genetic programmes written in the language of DNA nucleotide sequences. The entire cell is programmed for development and heredity in languages we have hardly begun to decipher.

Concluding Remarks

ReMine's book itself is very well-produced, with helpful footnotes and a good index. However it is expensive and some simple diagrams would have made many of ReMine's points much clearer. But these are very minor blemishes in relation to the enormity of ReMine's achievement. It is best summarised in his own words.

> 'When pressed … we can say that evolutionary theory ["the molecules-to-man explanation"]—as practised by its proponents—is unfalsifiable, since that is its essential character.' (p.464).

The evolutionist programme survives as the dominant view for one reason only:

> 'From beginning to end, their program is driven by an unrelenting commitment to naturalism, at the expense of science.' (p.468).

I can give no greater accolade than urging that this book should now be the starting point for all of our discussions.

Editorial Comment for "Sola Scriptura and Science" by Philip Duce

EDITORIAL COMMENT: *What place has our understanding of natural sciences in biblical interpretation? This is the question that Philip Duce considers here. He takes the contrasting opinions of Blocher and Lucas as marker buoys to help us navigate this challenging subject.*

For Blocher, science may not impose its authority on the Bible, but should be subordinate. He echoes the cry of the reformation, sola Scriptura. *Lucas argues that just as the linguistic and historical sciences are used in interpreting scripture, so also the natural sciences should be utilised, in order to draw truth from all sources.*

First, Dr. Duce indicates that human reason is a theological resource but not a source of Christian revelation. Secondly, he refutes the idea that the study of the natural sciences has nothing to contribute to a doctrine of creation, whilst warning about uncritical acceptance. Similarly, the role of experience and the value of Christian tradition, and the authority of the church are not to be denied. In addition, the phrase sola Scriptura *should not be taken to mean that all Christian truth is explicit in Scripture. Rather, Scripture is the final authority or norm for Christian belief.*

Dr. Duce concludes that the preferred approach is that of Blocher: the correct path must be that Scripture takes precedence over science, whether it be geology, psychology and any other branch. This approach should not lead to undue dismissal of the scientific enterprise and it need not imply that we will never revise our understanding of the Bible in the light of genuine discoveries.

Scripture is the final authority and also contains principles by which it may be understood. The challenge is whether our hearing of God's word is biased by our presuppositions and whether we allow particular scientific theories to have excessive influence on biblical interpretation.

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Editorial Comment for "The Flood Bottleneck and Genetic Diversity" by Marc Surtees

EDITORIAL COMMENT: *This article considers genetic variation affecting post-Flood populations of air-breathing animals. Classic Mendelian biology has a maximum of two alleles per trait per individual, with populations having the possibility of higher numbers of alleles. Critics of the biblical approach have asserted that the genetic bottleneck in the ark would have been a disaster for organisms, with a low ceiling on allele frequencies, impoverishment from subsequent inbreeding and with little opportunity for post-flood radiations.*

Since creationists have generally advocated a high degree of potential variability in these populations, the genetic challenge is significant. Are answers to be sought in a revision of Mendelian genetics (with individual genes affecting many traits and individual traits being affected by many genes, as confirmed by the Human Genome Project findings)? Are there other sources of variation that we should be exploring, that take us beyond the neo-Darwinian emphasis on chance mutations? Marc Surtees here contributes some stimulating thoughts around the theme of 'genomes designed to vary' so that we can perceive organisms as having a created capacity for variation. The editors are aware of a diversity of opinion in this area and are interested in publishing further contributions relating to the 'bottleneck problem' and will welcome wide discussion of these issues.

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The Basic Types of Life

PHYLUM	CLASS	ORDER	BASIC TYPE (BT)
Bryophyta	Muscae	Funariales	Funariaceae
Pteridophyta	Filicatae	Aspidiales	Aspleniaceae
Spermatophyta	Dicotyledoneae	Rosales	Maloideae
	Monocotyledenea	Poales	Triticaceae
Chordata	Aves	Anseriformes	Anatidae
		Galliformes	Phasianidae
		Falconiformes	Cathartidae
			Falconidae
		Passeriformes	Estrildidae
			Carduelinae
	Mammalia	Carnivora	Canidae
			Felicidae
		Perissodactyla	Equidae
		Primates	Cercopithecinae

The results of scientific research to elucidate the Genesis kinds
(see page 3)

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